A MODEL APPROACH FOR PLANNING SUBREGIONAL TRANSIT SYSTEMS

by

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CHAPTER I

INTRODUCTION

A variety of problems and needs facing nations in the world are bringing about changes in the institutions of government, industry and society in general. Transportation, because of its strong association with technological advancement and with the everyday needs of a changing society, has been highly susceptible to the demands for institutional change.[1*]

The nations' urbanized areas have experienced a tremendous population growth. Projected population growth patterns of these areas, indicate that these trends will continue. The ever-increasing use of the private automobile is one of the reasons for the poor vitality of the United States cities.[2] The extreme orientation to the utilization of the automobile as the basic mode of transportation has created a series of problems. Parking, congestion on urban streets, especially during periods of peak travel, increases travel time. Additionally, air and noise pollution in some areas have reached hazardous levels. High auto ownership and low population densities in rural regions have resulted in the decline of public transit systems in these areas. This trend exacerbates the mobility problems of the elderly, the poor and the handicapped.

Many regional and local authorities especially in non-metropolitan areas, who are faced with these and similar problems are contemplating public transportation as a solution. However, conventional transit

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1* Numbers refer to references at the end of the report.

planning processes generally developed for metropolitan areas are inapplicable to the needs and characteristics of rural areas.

The planning and implementation of a transportation system encompasses many factors. Primarily, investments in transit systems can be expensive so sound planning is essential. Extensive planning should be enacted to ascertain the contradiction of and/or the compatibility of the systems' objectives to actual conditions.

Urban Mass Transportation Administration (UMTA) makes capital grants under 16B(2) to non-profit organizations to provide transportation services for the elderly and handicapped. Also the Federal Highway Administration (FHWA) under its Section 147 of the Federal-Aid Highways Act of 1973 is carrying out demonstration projects to encourage the development, improvement and use of public mass transportation systems operating vehicles on highways for transportation of passengers in rural areas.

These programs place heavy planning responsibilities on local agencies that want to participate in them. Many of these agencies have no technical staff or "knowhow" and therefore, need some guidelines to proceed in this planning process.

PURPOSE OF STUDY

This thesis is aimed at:

1. Presenting a rational approach towards planning for a regional public transportation system.

2. Outlining a feasible method for organizing and accomplishing the required studies.

3. Providing a proto-type of technical study needed to implement a sub-regional transit program for the study area (Riley and Geary Counties).

This model approach was developed with particular reference to non-metropolitan regions with population less than 200,000 and population density of less than that of the core city.

The area of focus indicates that the planning approach will concentrate on rural non-metropolitan areas. Transportation planning has for a long time been geared toward large metropolitan concentration. Because the transportation needs of rural citizens have not had the visible political attention of urban areas, perhaps in part because some of the federal concerns such as air pollution and congestion are not as prevalent in rural areas,[3] the transportation problems of rural regions discussed earlier make it equally important to direct some attention to these areas.

LITERATURE REVIEW

Society has become increasingly concerned that some people have restricted mobility.[4] The private automobile is by far the dominant mode of transportation in contemporary America.[5] In 1973, over 83% of the households in non-metropolitan areas owned at least one automobile, compared to 77% in metropolitan areas.[6]

The survey completed for this study suggested that the higher percentage of non-metropolitan automobile ownership is somewhat attributed to the very limited public transportation available in those areas. However,

the same survey indicated that the private auto does not meet the transportation needs of all the rural community. In most rural Kansas counties, the average motor vehicle ratio to a family is roughly three to one.[7]

Several factors including scarcities of energy and raw materials, higher gas consumption and highway wear and tear make it imperative to encourage public transportation. Since for the past twenty years mobility in rural regions has almost always been limited to one mode, the private automobile, most governmental efforts to increase the mobility of the rural people have been confined to road development.[8] Those who cannot own or operate cars derive few benefits from such developmental investments.

In non-metropolitan or rural regions there are generally fewer community services available principally because the rural economy will not support these services. Nevertheless, rural residents, especially the poor, elderly, handicapped and the young have a great need for community as well as human services.[9]

Some very basic human needs are not being met because of the lack of travel opportunities for many rural people. Some are forced to own a car even though the cost of this ownership limits their purchasing power of other necessities. Ownership and operation of an automobile places a substantial financial burden on the vehicle operator.[10]

The journey-to-work travel is especially important to the non-metropolitan residents. Job opportunities do concentrate in relatively

dense areas and without reliable transportation, the isolated transportation disadvantaged are unable to secure or retain employment.[11]

The case for some form of transit service as a solution to the foregoing problem has already been made. Most cities and regions are in the financing and operational stages of transit systems and others are contemplating how to start. Despite the stakes and the immediacy of the problem, criteria for decisions relating to such systems do not exist in a commonly accepted form.[12] Elaborate planning methodologies involving massive direct involvement of citizens and elected officials are required.[13] Sound planning is crucial to the successful operation of any transportation system. A report on transportation and the elderly prepared by the Institute of Public Administration[14] states that "... improper planning has led to inefficient services, low levels of vehicle utilization and costly services."

OBJECTIVES OF THE STUDY

In an attempt to meet the aims and purposes discussed above, the study will discuss, initiate and develop the following elements of the planning process as outlined below:

1. Determination of a Transit Region

   Theory of regionalism has advanced some concepts in determining a planning region. This treatise will review some of the theories and methods as they relate to public transportation. Conclusions of the review and other factors pertinent in

establishing a planning region relative to rural public transportation will be established.

2. Development of Goals and Objectives

   a. Goals for transportation give direction to planning and become the basis for evaluating alternative courses of action. Establishing goals for a sub-regional travel system is a task fraught with complications because of the variety of interests involved. There is always the concern for reduced travel time and cost, convenience and comfort, reliability and safety. However, the treatise will develop a few guidelines for overcoming some of the complications stated above.

   b. Based upon the reflection of the attitudes and expectations of people in the subregion an attainable objective will be suggested for the subregion.

3. Inventory of Socio-economic and Land Use Characteristics

   a. A review of varying sources of data for scale and consistency as a necessary data base for sub-regional public transportation planning will be made.

   b. An assessment of travel needs of the area including both general public and the special transit markets will be made.

c. Since transit demand is a function of land use and socio-economic characteristics, particular emphasis will or would need to be placed upon the analysis of census data, existing land use information and other sources of information.

(1) Data elements, by established area units of analysis such as the number of dwelling units, population income levels, age distribution, auto ownership and population density would be used in this analysis.

(2) Employment concentrations and major activity centers would also be identified to provide an indication of the military personnel, students, staff, low income, elderly and handicapped persons within the study area and their location in relation to essential services, such as health, education, recreation, shopping, etc.

4. Inventory of Existing Systems

Any form of transportation planning involves a greater degree of accurate data base describing the activities that generate travel and the existing facilities that connect these activities.

a. A description and evaluation of transit services currently available is made whether the provider

of service is a public agency, private non-profit organization, or private company under contract. The identification of existing transit services and their characteristics is a key element in any transit planning. A profile will be presented of what to look for in this element of the plan.

b. Major areas inclusive in this inventory profile are:

(1) Capital equipment and operations of existing services;

(2) Costs and revenue data;

(3) Ridership characteristics.

c. Existing approaches to this part of the plan would be reviewed and a feasible approach will be proposed or recommended.

5. Establishing Latent Demand for Transit Service

This represents the potential number of people who would use transit if new or improved service were provided. It primarily reflects the potential ridership among people whose mobility is restricted and/or those who would use a service if initiated or improved.

a. There are three major approaches presently employed:

(1) Potential ridership survey;

(2) A demonstration program; and

(3) The use of aggregated travel behavioral models.

b. The proposed approach, "need as a criteria for estimating latent demand" will be analyzed and compared with existing approaches.

c. The different approaches will be applied to various segments of the study area. A criteria will be worked for the choice of feasible approaches in estimating latent demand in appropriate areas.

6. Evaluation of Transit Service and Development of Standards

a. Based on information obtained, an attempt will be made to establish certain standards. These standards will provide guidelines for determining the specific characteristics of service alternatives.

b. The treatise will present guidelines for establishing these standards and will do the same for the study area.

7. Alternatives

Proposals in solving the transportation problem should present alternative service concepts. The transit alternative should be appropriate for the existing conditions, latent demand estimates and service standards defined in previous sections.

Alternatives within transit modes or service types and operation would be considered. For the study area, travel

needs of major activity centers, i.e., Kansas State University, Ft. Riley, will be met. A framework for designing a transportation system for the transit market in the study area will be presented.

8. Evaluation of Alternatives

   a. Alternative plans should be evaluated on their potential costs and benefits. The compatibility of each alternative with the standards of service, needs and local goals and objectives that were defined earlier should be evaluated.

   b. Methodology of evaluating alternatives will be presented and tested on those alternatives for the study area.

   c. The final product would be a model or framework for preparing regional transit plans and a subregional transit development program. The model will propose three major systems integrated together for the study; one unit to serve Manhattan, then along the corridors of Manhattan, Ft. Riley, Junction City. The code name for the final project is MARIGETA.

9. Plan Implementation

Financial, legal, operations, and organizational aspects of final plans should be reviewed for implementation. Monitoring and revision of plans are also part of this planning process.

Some procedural steps would be presented and applied to the subregional plan.

RESEARCH PROCEDURE

Some theoretical concepts and approaches to various phases of transit planning were reviewed and in some cases, comparative criteria were examined to select a feasible approach for non-metropolitan areas.

The most feasible approach will be discussed in detail in an effort to demonstrate how it is applied. In evolving this demonstration method, it would be applied to the study area on a pilot basis.

SCOPE OF THE STUDY

The more preferable term, "public transportation" will be used in the report but interchangeably with, "public transit." Both have the popular misconception of, "monsterous" mass rapid fixed rail systems of metropolitan areas. These terms are used here to refer to services offered on a fixed route basis of the urban areas within a region, transportation services of special clientele and taxi cabs offering intrastate services.

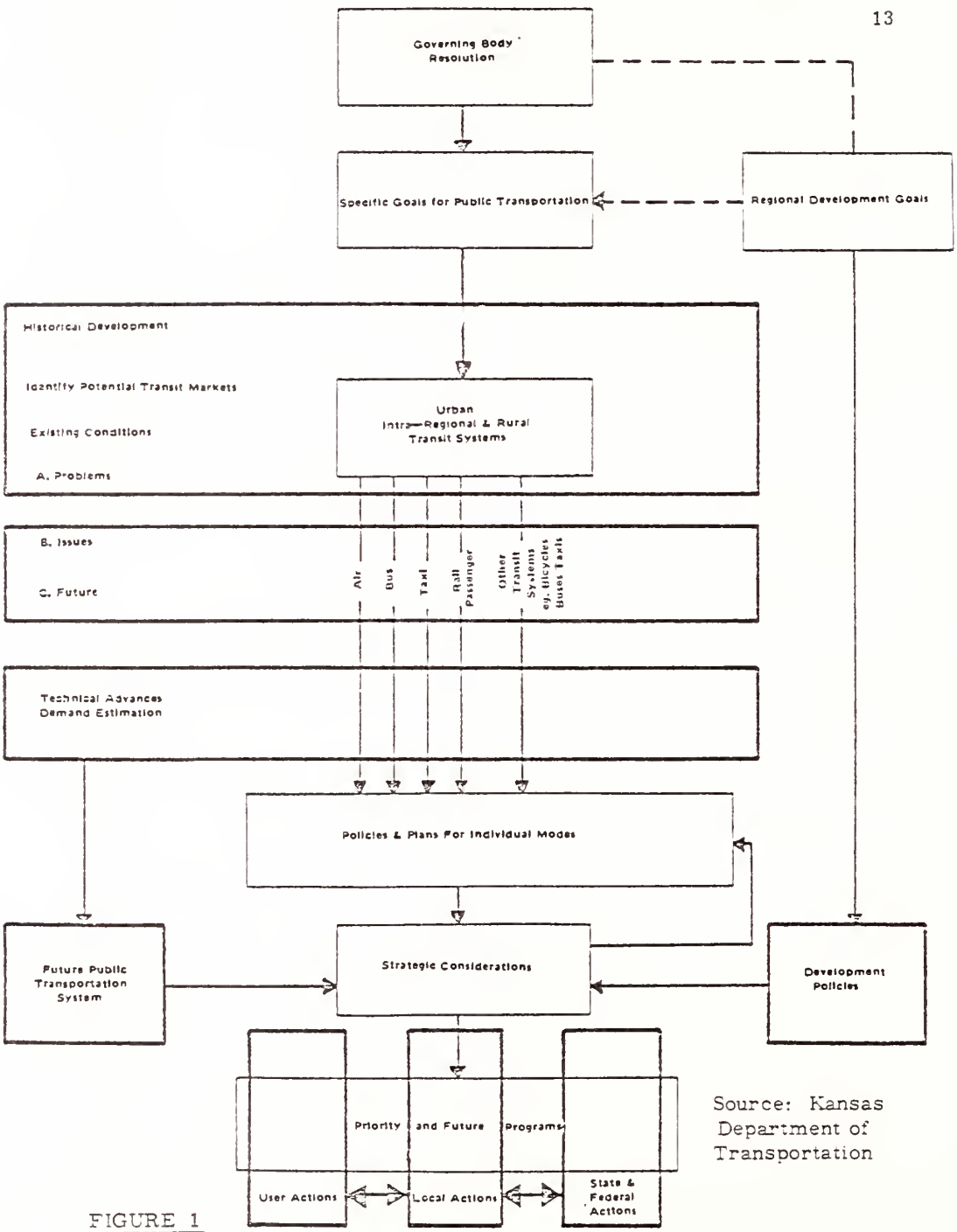
The study will include recommendations on the use of school buses as a possible alternative in solving the transportation problems of transit dependents. However, no serious attempt is made here in investigating into the seemingly complex legal and administrative issues surrounding this transit system.

The terms, "transit dependent," "transportation disadvantaged," and "restricted mobility residents" are also used interchangeably to refer to the elderly (aged 65+), handicapped, low income recipients and other segments of the population identified as those who may need some form of transportation because of physical, age or economic handicap.

The planning procedure was extended on urban transit services, and taxicab operations within the region. The procedure was conducted on a limited basis within the study area, which for the purpose of clarity and avoiding ambiguity is called a subregion, to differentiate it from the area of jurisdiction of the local Regional Planning Commission. However, the model of framework developed is applicable to total region as defined in Chapter II.

The overall planning process is presented in a schematic flow chart on the following page.

PROCESS BY WHICH REGIONAL PUBLIC TRANSPORTATION PLANS ARE DEVELOPED, COORDINATED AND IMPLEMENTED



Source: Kansas Department of Transportation

FIGURE 1

CHAPTER II

DETERMINING A TRANSIT PLANNING AREA

We no longer need to debate the issue of "Regionalism." Politicians and the voting public they represent have both recognized that we must solve those problems that fail to stop at artificial city and county boundary lines and will require more than our own local governmental powers to bring about solutions. The issue for the 70's and 80's is, "How are we going to develop and implement the needed regional solutions and who is going to be responsible for the process?"[15]

These are the words of Mr. Francois, who was the president of the National Association of Regional Councils. From this vantage point he observed regionalism at work and his comments are chosen to start the theorical discussion of transit planning and regionalism, because of the implicit subprograms in his statement.

> "Regionalism can be a particularly effective tool for non-metropolitan areas and the smaller communities located within them. Experiences of many regional organizations have shown that within certain established geographical boundaries communities share many of the same problems. Together, they can form a base for doing things which they cannot do alone. What eventually emerges from such a regional association is based on 'grass-roots' decisions. Local initiative is given new meaning."[16]

Similar statements and testimony have been paid to regionalism and therefore our concern here is not "why regionalism" but how transit planning can be done on a regional basis and in establishing the appropriate region.

Regional planning may encompass two major activities; policy and functional planning. Transit planning is considered as a functional planning activity.

> "This is quite simply the planning necessary to assure the wise, efficient and effective provision of the major services required in any good living environment."[17]

The theories of central places tend to offer an explanation for how transit regions are formed. People will travel to the location of basic human services to satisfy their needs and the concept, "travel is to the transportation system what current is to an electrical network," stresses that transportation services link people with their needs. There is a hierarchy of service activities ranging from low order services found in every town to high order services found only in major centers. So people may have to travel longer distances for certain types of services. Therefore, each service activity has a threshold population and market range.[18]

The market range of a service activity is that distance which people are willing to travel to reach the service. It is the outer limit of the market area for the service activity beyond which people will look for another center. So by identifying various services that generate and attract trips, the location of these services, and their market ranges, not only are core areas being determined but also geographical boundaries would be established for the market range and hence the transit region.

The foregoing process is called "Regionalization" and it takes several forms depending on the purpose of the functional planning, the

criteria to be used, and the available data. In absence of adequate data, qualitative intuitive approaches have been used, but this tends to lead to very obscured regional boundaries which, the more closely they are examined the more vague they appear.

The process described earlier has the advantage of grouping together local communities which display a considerable degree of interdependence. The concern is thus more with the flows that are linked to a central point rather than with the uniformity of the region as a whole. In this functional regionalization, the concept is based on the direction and intensity of flows between the dominant center where most high order services are concentrated and the surrounding communities, each flow showing decreasing intensity as it approaches another center. The boundary or sphere of influence of the dominant center will be where the flow intensity is at a minimum. The flows are of varying types. They can be economic, recreation or transportation.

Using the process described earlier, a transit region can be established as follows:

1. Identifying of regional functional activities; that is high order service and facilities in the generalized area which may include the following elements:

   Shopping centers

   Medical facilities

   Recreational centers

Commercial centers

Social service facilities

Employment centers, etc.

2. Establishment of the market range of the above-mentioned elements by the following procedure:

   a. Through the records (such as bills, forms, etc.) of the functional centers established above, the origin of the clientele to these centers can be identified. This data is analyzed and transposed on a map to delineate the area.

   b. It is also possible to record license plate numbers of vehicles found at the activity centers. A check with the local vehicle registration agency will reveal the residence of owners and then the area of influence of the various services would be established.

   c. Other approaches in delineating functional regions are:

      (1) Origin and destination survey

      (2) Graphical project method

      (3) Gravitational model.

Practical Application

Planning regions, however precisely defined on the criteria of formal or functional regionalization, may not correlate with administrative areas. Planning areas that transcend political jurisdictions create severe

resistance for successful implementation. There are several factors that make it imperative to substitute political and administrative feasibility for theoretical efficiency. These factors include established financial base to fund project proposals, coordination with other agencies to achieve objectives of the community and already established political framework for which public transportation programs can be a part. These factors and others compel the planner to consider the regional boundaries to be coterminous with existing political jurisdictions.

While the planning area may not necessarily be coterminous, attempts should be made to contain it within manageable political structure. If it has to cover other adjoining jurisdictions, a substantial portion of those areas should be covered to obtain the necessary cooperation and support of adjoining areas. Otherwise, as much as it can be avoided, planning areas should not transcend state boundaries and/or necessitate the creation of another level of government.

If the above conditions have been smoothed out by other programs, e.g., an existence of an interstate governmental cooperation, then the planner has the flexibility to make more theorical regionalization possible.

Implicit in all these considerations is the size of the system being conceived. There is an optimum area that any system can conceivably cover.

If the planning region is going to be the same as the service area then the following subprograms should be considered:

1. Available resources in terms of human and material hardware;
2. The level and standards of service the planner is hoping to achieve and maintain;
3. The areas being covered by existing transportation programs and systems.

A variation of the planning area would be to make the planning area larger than the service area. The regional transit planning area can then encompass many transit systems and microsystems' service areas. For example, a planning region may contain two or three big cities; an area-wide system can be planned to cover the whole region, connecting the cities. Even within the cities respectively, subsystems may be provided to take care of local travel demand. Alternatively, respective cities can have their systems and subsystems and the role of regional planner here is to coordinate activities of various systems and also take care of overlapping service boundaries.

In summary, in identifying an area for transit planning purposes, the following should be considered:

1. Political and administrative boundaries

   Any planning that ignores existing political boundaries would be hard to sell, especially in the implementation stages

of the plan. At a glance it would appear that what is feasible theoretically would vary with the enterprise at hand, with the area in which action must be mounted, the goals one has in mind, but in the final analysis it is the political actors who decide what is feasible. Taxes and other government finances from which public programs like transportation are paid, are structured along county and city boundaries. Local governments may not pay for programs if they do not see a substantial benefit to their area of jurisdiction. So attempts should be made to consider political boundaries and cover larger portions of political jurisdictions.

2. Respect to existing program boundaries.

Regional planning commissions which undertake economic and community development planning have been established in many states. If public transportation planning is to have a desirable objective of assuring that people have access to social and economic opportunities, then it should be looked at as an integral element of a whole comprehensive regional planning process. Needless to say, then, the planning should be done within the same area boundaries of other programs that impact on the transit plan.

3. Establishing areas of administration by regional planning commissions.

In most states consideration was given to the uniformity of socio-economic and political characteristics of respective units that constitute their areas. Those factors make it more convenient to plan for public transportation within their boundaries. The commissions are usually given implementation powers and administrative structures which will be an advantage to programs conceived out of the planning processes. However, if for some other reasons boundaries have to be established, then consideration should be given to the uniformity of socio-economic and political characteristics of the counties aggregated together, also, the area of coverage of existing public transportation systems, if any.

Determining the Planning Area for the Study

The concept of regionalism is not a new one in the State of Kansas. It has become an effective means for intergovernmental cooperation and economic and community development. There are fourteen multi-county regional planning commissions in the state and the Big Lakes Regional Planning Commission is one of them.

Big Lakes Regional Planning Commission is made up of Clay, Geary, Pottawatomie and Riley Counties. There are several common elements, physical, political, and socio-economic characteristics that bind these counties together for development. The two urban areas,

Manhattan and Junction City, have the same kinds of high order services whose market ranges extend across the four counties.

Economically, Kansas State University and the military base at Ft. Riley draw their employees from these four counties. Information from the Personnel Office at Ft. Riley indicates that the personnel of the military base live within the four-county region with the highest concentration in Riley and Geary Counties. Socially, the two water reservoirs, Tuttle Creek and Milford Lake provide recreational facilities for residents in the region and beyond. In fact, there are a lot of externalities in terms of resource beneficiaries extending beyond the political jurisdictions of the counties. A classic example is the city limits of Manhattan extending from Riley County into Pottawatomie County.

This planning and development region was chosen because of the author's familiarity with its socio-economic fabric and knowledge that planning authorities in the region would like to have such a study done. Also, the convenient availability of data contributed to this decision.

This treatise identified the two counties of Riley and Geary Counties as a subregion instead of treating the whole Big Lakes Planning Region, because of the developmental corridor from Manhattan to Junction City. Most of the personnel of the military base reside within this corridor, (See Chapter III) and their "journey-to-work" travel makes it a unique case for a transit study area. Also, students and staff of Kansas State University live within this corridor but not

necessarily within the jurisdictional boundaries of the City of Manhattan.

Narrowing the planning area to a two-county area does not compromise the whole planning region as a homogeneous area, and the planning exercise does not stop along the jurisdictional boundaries of the county. The catchment area of the corridor is considered, but the data of the areas beyond the prime study area was estimated. By any rate, there should be a cutoff point which the theory of central place would define as the outer limit of the market range beyond which people will look for another center.

The planning area was narrowed to the subregion not only because of the advantage of population and area covered, but also in terms of the scale of the study and the potential transit system to be conceived. The smaller population and geographic size of the subregion, instead of the whole Big Lakes regional planning area affects the scale of planning study by reducing data collection and manipulation problems. Scaling down the size avoids the use of computer techniques and replaces them with simple and heuristic techniques.

The problems of intergovernmental cooperation are not anticipated for the study area because of the existence of a local council of governments.

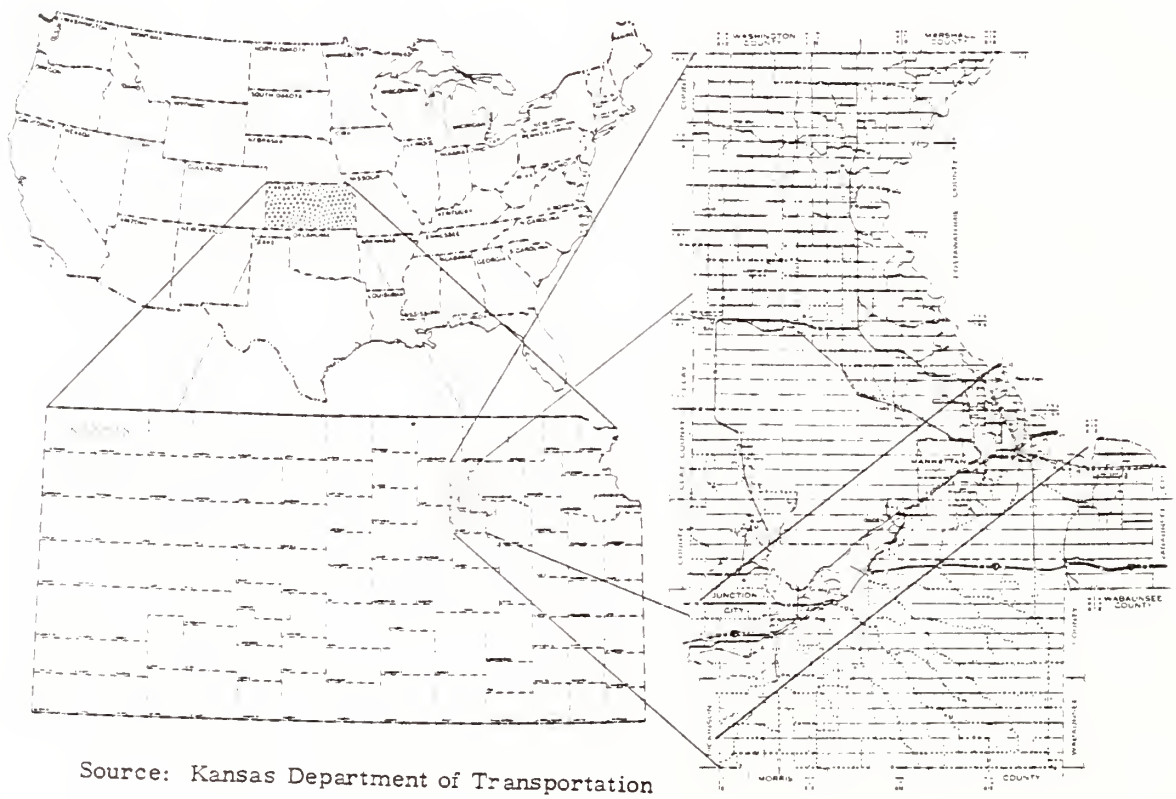
Conclusion

It must be emphasized that the major impetus for areawide planning and programming is economy of scale and this appears not to be a unique characteristic of public transportation planning. An arbitrarily larger

area may not be economically feasible, for there is very little relevance to the supposition of the relationship of systems size and efficiency, except in a situation where anticipated captive riders are densely spread over a larger area or multi-model transit systems are being conceived. Otherwise, "small is beautiful" and manageable.

A map showing the geographical location of the study area and its relationship to the state and the nation is shown on the next page.

THE GEOGRAPHIC LOCATION OF THE TRANSIT CORRIDOR OF
RILEY AND GEARY COUNTIES



Source: Kansas Department of Transportation

FIGURE 2

CHAPTER III

DEVELOPING GOALS AND OBJECTIVES

If planning is to be conceived as an exercise in achieving the health, safety and convenience of human life by efficient utilization of resources, then some idealized end must be aimed at as to what constitutes the acceptable level of health or convenience to be achieved. Before any meaningful goal can be set, what is being planned for should be defined. The first step then before identifying goals would be to develop a clear statement of the problem and it's domain. Implicit in the problem statements are the purpose of the planning exercise, the scope, the time frame and the clientele that the whole planning exercise is to be concerned with.

After defining what the extent of the planning exercise is about, the stage is then set to establish some goals, objectives, criteria and standards.

Goals are conceived as idealized end or aims toward which individuals, businesses, organizations and communities strive.[19] Almost all goals are vague and general, and it appears they can never be achieved. For example, a common transportation related goal is "to provide for convenient social and economic interaction in the community." The question is, "how convenient is convenient?" There appear to be no measures to gauge how well such goals are being achieved. Identifying goals is one of the most useful but difficult exercises in the planning discipline. Many planning efforts fail because of the imprecise nature of the goals set, and

even the definition of the word goal itself. Any prolonged discussion of goals will become enmeshed in semantic difficulties arising from different concepts as to what constitutes a goal.

Goals are useful as a concise expression of societal values, but to be useful for evaluative purposes, they must be related to a set of specific objectives.

Objectives emerge from the process of goal-setting and are concise and precise statements aimed at how to achieve the goals of the society. They may be conceived as a criterion against which the performance of a program would be evaluated. The wording of objectives is very important. If it is specific enough, it will suggest appropriate measures of how well a given alternative can be or is being achieved. A set of properly developed goals and objectives will point out areas of conflict in any program.

The fact that every action has a reaction makes the determination of objectives a bit uneasy. Objectives stated in a compound sense, for instance a desire to minimize both transportation costs and travel time, are impossible to achieve. Also, a program designed with dual objectives, for instance to ensure safety and efficiency could be conflicting objectives. At this point, the priorities of the community should be determined by citizen participation early in the planning process.

The stage of formulating goals and objectives is of vital importance in the planning process and has recently been assuming a much more significant role.[20] Unfortunately, the generality of goals and objectives

leaves much to be desired, as does the lack of public participation in identifying them. Therefore, some measures of criteria and standards are necessary.

Criteria are a set of rules and regulations or measures applied to objectives to determine how they are being achieved. They help measure alternatives against some desirable attributes. Theoretically, they are intended to measure the level of attainment of objectives, but only quantifiable criteria can be measured easily; qualitative objectives are difficult to evaluate.

A standard is a level of attainment above which an alternative is acceptable. For example, if the general acceptable standard is that individuals be able to make two trips a week, one can say the standards have been met by any program that satisfies this demand.

A rule of thumb for formulating objectives is hard to find but Peat, Marwick and Mitchell have spelled out a few points in their publication, "Analyzing Transit Options for Small Urban Communities" which are worth considering.[21] They are:

1. Objectives must be precise.

   Precision is a collary of objective information and is necessary to make evaluation possible;

2. Objectives must be measurable but not necessarily quantifiable: a statement of an objective should at least imply the criteria for measuring achievement of the objective;

3. Objectives must be tied to a specific transit service;

4. The set of objectives should be comprehensive;

5. Phrasing of statements should be such that they will be amenable to change if the need arises;

6. Objectives pertaining to the performance or quality of a transit service should be based on a careful appraisal of the underlying problem and particularly on the special needs and preferences of the intended market.

Miller and Millar[22] indicate that the problem of rural transit can be stated as follows: "Is there a need for public transportation that can or should be met by government or private agencies?" This question leads us to "how" and "who" should decide on or participate in formulating the transit objectives.

Implied in this problem statement are the following subprograms:

1. Measurement of need both in terms of potential usage and political support for public funding of a system which will most likely not be financially self-sufficient.

2. Design of a public transportation system which provides sufficient benefits to warrant the public and private costs.

3. Design of a system which meets state and federal guidelines in order to ensure funding.

The problem is as much political as technical, since the basic issue is a "yes" or "no" one on the very existence of initiation of a transit system. In the non-metropolitan areas the transit problem is more than making minor modifications to an on-going operation. There are a multiplicity of problems in rural regions and public transportation systems occupy a low priority for receiving local tax monies as compared to some needs as schools, roads and streets.

Three basic approaches can be taken to gauge public support. The first approach is where the planner can deduce transit goals from major development goals of the community. Usually these goals are expressed statements in comprehensive or master plans of the community which had been adopted either by referendum or by the governing body's resolution. Objectives developed this way should compliment the total goals of the community. (See Figure 1.) For instance, let us assume that a goal for a Regional Development is, "Maximum Utilization of Human Resources." Out of this goal, economic, education, and housing objectives, among others, would be formed to compliment the goal. Similarly, a public transportation objective such as "enhancing the mobility of the residents in the region" could be evolved out of a goal to "maximize human resources."

This approach leaves much room to be desired because the decision-makers usually do not consider well enough the explicit and implicit implications of the objectives and usually this affects program implementation when they come to realize the details of the program. Also, it is possible

that the intent of the governing body or residents expressed in an already approved comprehensive plan may have been different, if they had realized that public transportation is part of the plan.

The second approach is only a variation of the first one; planners and decision-makers can consult with some community leaders and interest groups to determine the nature and extent of specific transportation objectives. Since political leaders appear not to be too enthused about a technical subject like formulation of alternatives, it often ends up with the planner imposing his own statements and priorities.

An approach favored by this author is carrying out an attitudinal survey. This survey questionnaire should pose the questions discussed above and all of the subprograms implied in the problem statement. It is highly important that most of the problems and issues concerning public transportation be identified initially and such that the attitude of the community can then be accurately determined on them. Inclusive in this determination, should be the opinion of respondents on using public funds for transit initiation improvement and programs.

A refined approach is to carry out the attitudinal surveys and stratify the population of interest by the general community, the user, and the political decision-makers. This depth will give the planner some areas of specialization, concentration and flexibility. However, if there are no special problems for qualitative investigation, detail probing should be sacrificed and a general attitudinal survey would be sufficient for goals

formulation and planning direction. (See Appendix B for an exhibit of a questionnaire designed with the study area in mind.)

The relevance of each question is obvious. The questions reflect four core areas which any transit planning process should consider. It also tries to get direction on the relevant questions that rural transit problems pose. The core areas where questions were directed are:

1. The need for public transportation and implied subprograms. (Questions 1, 2, and 4.);
2. Provision or supply of public transportation;
3. Planning and coordination of transit services;
4. Funding of transit services.

The Survey Coverage

This step involved defining the population to be studied. For a general attitudinal survey, the term "community" has to be defined and who the constituents are. Two approaches seem evident in this situation: either cover the whole, or part of the people in the region, or their political representatives. (In the latter case, most opinions in such surveys may be "politized" and may not reflect the true aspirations of the residents.)

A sample of the general population was preferred in the case study. It was chosen because of economics and other considerations to be explained later.

The following sources were considered for a sampling frame which should contain the names and addresses of all residents in the region.

It is difficult to come across such lists but consideration here was given to the list that does not deliberately exclude any section or group of people socio-economicwise.

1. Telephone Directory
2. Park Directory
3. List of voters in recent elections
4. Tax Roll, etc.

In the case study, county-wide telephone directories published by the Central Publishing Company, Iola, Kansas were used as a sampling frame. This list was preferred over the others because of its nearly up-to-date status, however, it did exclude non-telephone users, especially low income people.

The people excluded by using the telephone book are also likely to be poor and transit services will be more important to them than other economic classes. Two sampling methods should take place to circumvent this problem. A systematic stratified random sample should be used. If the sample produces less variability of population groups then a greater sampling should follow to augment the deficiency of the first sample. The population of interest should be stratified as:

a. Restricted mobility, i.e., low-income, elderly and handicapped.

An additional list from a social agency like welfare recipients will suffice for low-income people. Similar lists can be obtained for the other groups.

b. Political, administrative and civic leaders.

Then, if the survey has to cover 100 persons, a systematic random sample should select, say 75 people. This list is checked with the lists of (a) and (b) above. If none of the names appear within the systematic sample of 75 people, the remaining 25 are selected from the quota sample by some proportion according to their percentage within the whole population of the region.

The following advantages were realized in the pre-test of the case study by utilizing the above procedure:

a. There was a greater variability within the total sample selected.

b. It is quite evident in rural regions that public transportation occupies a low order in the priority of residents.

The problem appears to be that of a minority. By their inclusion in the sample, their opinions were considered in identifying transit planning goals for the region.

Sample Size

The sample size for this type of attitudinal survey should be decided basically on experience, the level of precision required and the available resources. A small sample will save labor, since fieldwork, tabulating and processing a big sample data will involve a greater amount of time, resources and money. According to Krueckeberg and Silvers[23] the

following general principles are true and fairly useful:

"1. The more disastrous the effect of poor information would be, the larger the sample required.

2. The more varied the responses are expected to be, the larger the sample required.

3. The larger the total population being sampled, the smaller the proportion of it that is required in the sample.

Each of these rules pertains only when other things are equal."

Since rural areas have small population sizes, a higher percentage of coverage of the total residents in the region should be considered to establish validity of conclusions so it would be more representative of their type of sample design, non-response, etc. Whatever size chosen should be statistically valid. See Appendix A for standard error formulas. An arbitrary sample size of 10 was chosen to be covered in the pre-test for the study area. The 10 were chosen as the representatives of various categories concerned with public transportation in the subregion.

Analysis of Attitudinal Surveys Expressing Transportation Concerns

Various methods can be used to analyze questionnaires administered to gauge resident's views and concerns of public transportation problems and issues. The data obtained from the study area was not quite sufficient to demonstrate the methods discussed herein. Therefore, a similar survey administered in Osage County by the Kansas Department of Transportation was used. Conclusions in this report were made from the pre-test data

obtained in the study area, however, it is believed that a more extensive formal survey carried out in accordance with the processes discussed earlier would reaffirm the conclusions that were made from the limited sample.

The Osage County Study Data

The Planning and Development Division of the Kansas Department of Transportation (KDOT) administered a Community Attitude Survey in Osage County to obtain the necessary local input with the preparation of the Transit Development Program (TPD) for the county. Respondents were the members of the Board of County Commissioners, City Commissioners of Olivet, Carbondale, Quenemo, Lyndon, and Overbrook and some other public officials within the county. Twenty-nine questionnaires were received, representing about 95% returns.

Nineteen questions regarding various transportation issues were included (See Appendix B). Respondents were asked to indicate the extent of their agreement or disagreement with each statement on a five-point Likert-type scale: (1) definitely agree, (2) generally agree, (3) mixed opinion, (4) generally disagree, or (5) definitely disagree.

Responses to the questions were analyzed utilizing factor analysis to identify inter-correlations among responses in order to determine the existence or absence of underlying common factors in attitudes and opinions on transportation issues and problems, and to provide a statistically supported basis for categorizing these issues and problems in a meaningful way.

Statistical Approach

The questionnaires were collated and tabulated on a matrix of question numbers and Likert scale. The data analysis utilized the "Statistical Package for the Social Sciences (SPSS)" computer program (Electronic computer system). The following statistical measures were needed to analyze these questionnaires:

1. The mean score of each question;[24]
2. The standard deviation of each question;
3. The frequency distribution of the responses to each question.

The "Most Common Principal Algorithm" method was used in grouping questions into five categories. The method identifies a factor which is a linear expression of all the study elements with each variable weighted by a term that reflects the degree to which the variables contain the common element represented by the factor. In essence, then, a factor is a super-variable made up of all the variables in a study. Five core factors were identified in this study and the questions were grouped and analyzed under these factors:

1. Need for public transportation;
   (Questions 3, 1, 2 and 5)
2. Provision of supply of public transportation;
   (Questions 8, 7, 12, 11, 14 and 17)
3. Planning and coordination of transit services;
   (Questions 9, 15 and 19)
4. Finance or funding of transit services;
   (Questions 4, 6, 13 and 16)
5. Miscellaneous;
   (Question 18).

Analysis of the results is as follows:

A. Need for Public Transportation

Question 3. Is there a need for transit system in your area?

Yes	7
No	16
No Opinion	6
Mean	2.36
Standard Deviation	1.5
Interpretation	No.

Question 5. Which is more important in your area, street and highway improvement or provision of transit service?

Highway	20
Transit	4
No Opinion	5
Mean	4.103
Standard Deviation	1.4
Interpretation	Highways are more important to the respondents.

Question 1. Is transportation a problem for the following categories of people?

	Yes	No	No Opinion	Mean	Standard Deviation	Interpretation
Elderly	12	11	6	3	1.6	Yes
Handicapped	8	15	6	2.6	1.6	No
Low Income	5	21	3	2.4	1.4	No

Question 2. Do these people need a dependable bus system?

	Yes	No	No Opinion	Mean	Standard Deviation	Interpretation
Elderly	10	14	4	2.75	1.7	No
Handicapped	7	16	5	2.36	1.6	No
Low Income	5	21	2	2.04	1.5	No

B. Provision

Question 8. Should a transit system be provided for the following categories of people?

	Yes	No	No Opinion	Mean	Standard Deviation	Interpretation
Elderly	10	14	4	2.7	1.5	No
Handicapped	9	15	4	2.6	1.6	No
Low Income	4	23	1	1.8	1.3	No
General Popul.	5	19	4	2.1	1.4	No

Question 7. Should local government take a role in providing transportation?

Yes	12
No	12
No Opinion	3
Mean	3.22
Standard Deviation	1.65
Interpretation	Yes*

* The frequency distribution shows that the deviation about the mean of this result gives a positive response to this question.

Question 12. A privately owned taxi system provides all the necessary transportation needs of the ff categories of people.

	Yes	No	No Opinion	Mean	Standard Deviation	Interpretation
Elderly	7	21	1	1.35	0.7	No
Handicapped	2	21	-	1.43	1.16	No
Low Income	2	21	-	1.39	1.16	No

Question 14. A volunteer service made up of people donating their time and vehicle should provide transportation for the ff categories of people?

	Yes	No	No Opinion	Mean	Standard Deviation	Interpretation
Elderly	10	11	8	2.93	1.6	No
Handicapped	10	12	7	2.79	1.6	No
Low Income	10	19	5	2.14	1.6	No

Question 17. Local government should rely on private non-profit organizations to provide transportation for the ff categories of people?

	Yes	No	No Opinion	Mean	Standard Deviation	Interpretation
Elderly	14	9	4	3.30	1.59	Yes
Handicapped	13	10	4	3.15	1.68	Yes
Low Income	11	12	4	2.96	1.72	No

Question 11. Should school buses be used for public use during non-school hours?

Yes	3
No	20
No Opinion	3
Mean	1.89
Standard Deviation	1.24
Interpretation	No.

C. Planning and Coordination

Question 9. Is there a need for increased coordination of existing services?

Yes	10
No	8
No Opinion	5
Mean	3.087
Standard Deviation	1.56
Interpretation	Yes

Question 15. Should the local government take a role in planning and coordination?

Yes	10
No	8
No Opinion	5
Mean	3.08
Standard Deviation	1.56
Interpretation	Yes

Question 19. Should local officials be given adequate opportunity to express their wishes in this planning effort?

Yes	21
No	3
No Opinion	4.3
Mean	4.3
Standard Deviation	1.16
Interpretation	Yes

D. Finance

Question 4. Should local government finance transportation for the following categories of people?

	Yes	No	No Opinion	Mean	Standard Deviation	Interpretation
Elderly	1	21	4	1.8	1.08	No
Handicapped	1	23	3	1.6	0.97	No
Low Income	1	23	3	1.6	0.197	No

Question 6. Should a mill levy be passed to support transportation?

Yes	11
No	13
No Opinion	5
Mean	2.78
Standard Deviation	1.63
Interpretation	No

Question 16. Should local government take advantage of state and federal public transportation programs?

Yes	1
No	19
No Opinion	6
Mean	1.65
Standard Deviation	0.98
Interpretation	No

Question 13. Will citizens support a reasonable local subsidy for taxi operators to provide transportation for the ff categories of people?

	Yes	No	No Opinion	Mean	Standard Deviation	Interpretation
Elderly	2	26	1	1.38	0.86	No
Handicapped	1	27	1	1.24	0.69	No
Low Income	0	28	1	1.17	0.47	No

E. Miscellaneous

Question 18. Will support become apparent if the need for public transportation increases?

Yes	16
No	5
No Opinion	5
Mean	3.5
Standard Deviation	1.38
Interpretation	Yes

According to this survey, the respondents believe that there is no need for an area-wide transit system and view highway improvements as more important in their development priority than provision of transit service. They do not perceive transportation as a problem for the elderly. Apparently due to the present service provided to the elderly by ECKAN they do not think that the elderly need extra service. The respondents have this same opinion about the handicapped and low income people, despite the unavailability of a special vehicle with necessary equipment to serve the handicapped. In the respondents' opinion no transportation system should be provided for these people and their local government should not be involved or take a role in providing transportation. Privately-owned taxi systems do not provide the necessary transportation needs of the transportation disadvantaged. The words of one respondent appears to explain the concensus of opinion, "We have no privately-owned taxi system and we do not need any, for any people." The local officials do not think that local citizens will support a local subsidy for taxi operators to provide transportation services for the needy. They do not share the opinion of a volunteer service made up of people donating their time and vehicle to provide transportation for the disadvantaged. However, they feel it is alright for their local government to rely on private non-profit organizations to provide transportation services for the elderly and handicapped. The local officials do not concur with the idea of using school buses for public use during non-school hours.

Planning and Coordination

They perceive a great need for increased coordination of existing services and the local government and its officials should take an active role in this exercise.

Finance

Approximately 96 percent of the people who answered the questionnaire do not want local government funds to be committed to provide transportation for the elderly, the handicapped and/or the low income people, and would not support a mill levy for such activity. The following comment extracted from a letter submitted by one of the respondents threw some light into this assertion. "At this time I feel our city and many others just haven't got the money to support such a wonderful service. Therefore, I will have to say I cannot favor any program in which our city would have to pledge financial aid." Assuming the need for public transportation is not high now, respondents agreed that support for it will become apparent if the need increases. Respondents do not think they should take advantage of Federal and State public transportation programs.

Comments on the Survey

As it was expected the responses to the issues raised in the questionnaire reported above received negative responses from the respondents. A possible explanation to the above results can be the nature of the sample covered. The respondents were only elected local politicians and a few appointed public officials. It is a well known fact that in political behavior

studies that politicians will support only issues that have "political sex appeal."[25] That is, those issues that they can reasonably measure that their constituents will support and know about them. In other words, most politicians tend not to generate issues and will wait for public reaction before they express opinion especially on programs that will tax the public purse. Therefore, their first time opinion may be negative (to be on the safe side) until convinced that the whole community supports such a measure.

Also the "elite theory"[26] indicates that politicians tend to represent the opinion of the elite class and give very little concern to average citizens roles appears to benefit from a program such as public transportation. To remedy this situation, the survey should be administered to cover all segments and groups within the population as much as possible. The result will provide the decision-makers the mandate and the support to accept or reject recommendations that would otherwise not have been.

The foregoing comments support the basis for stratifying the population as discussed earlier and also broadening the base of respondents to include those directly affected by the problems of public transportation. After all, the basis of democracy is pursuing the wishes of the majority and ensuing the rights of the minority. This contention was reinforced when the results of the pre-test survey of the study area was compared with the data reported above. There was a greater variability within responses to questions and the following concensus became evident.

1. A desire for a regular multipurpose transportation system.
2. A desire to utilize state and federal funds to provide for this service.
3. A belief in coordinating existing transit services.
4. A belief that certain segments of the population (the elderly, handicapped, and low income individuals), should be provided some form of transportation.

It should be pointed out that the opinions expressed in the two surveys (Osage County and the study area) were not expected to be the same because the results of the Osage County survey is not a true reflection of the residents in that county since the respondents were mainly political representatives. What this part of the treatise set out to demonstrate is the research technique for identifying transportation concerns of residents in a region and formulating goals and objectives on these concerns. Thus, providing a statistically supported basis on transportation system decision-making by taking into account the major concerns of the people to be served by the system. This in turn should substantially increase the probability of community acceptance and patronage of the systems. Based on the results of the pre-test survey administered in the subregion the following goals and objectives appeared to be emerging.

GOAL I - To provide a comprehensive and coordinated system of sub-regional transportation with maximized benefits from limited public resources.

Complimentary objectives - To effectively utilize existing public and private transportation operations such as the Bell Transportation Service and Aging Transportation Agency as part of a subregional transportation system.

GOAL II - To encourage transit usage by the general public.

Complimentary objectives - To develop marketing strategy including radio and T. V. advertisements that will invite non-transit dependent persons to use the service as energy saving and parking space measures, an alternative to the private automobile.

GOAL III - Provision of a safe, efficient and reliable regional and subregional system that will meet the anticipated needs for the movement of people in Riley and Geary Counties.

Complimentary objectives -

a. User

(1) Reduce the severity and frequency of accidents;

(2) Insure the dependability of transportation.

b. Provider

(1) Provide necessary assistance to encourage transportation system operators to move people at economical capital, maintenance, and operating costs.

c. Community

(1) Provide for a safe environment;

(2) Increase subregional accessibility.

Conclusion

Macy and Heathington, et al., [27] identify a negative attitude toward transit as a common characteristic in small towns. This attitude is not unique to small towns, however, it is more complex in this setting. In large urban areas, transit is usually considered an inferior mode of personal travel, but is recognized as a necessary part of the urban transportation system. In small urban areas there is little justification for transit based on congestion or air pollution, thus residents feel it is unnecessary. Negative connotations of ugly big city problems are also part of the adverse reaction. Surveys often reveal less than majority support for transit subsidies in small urban areas. In Sharon, Pennsylvania, for example, only 47 percent of the city employees favored support of transit. However, citizens opinion surveys give a good gauge for objective formulation and what alternatives are likely to be acceptable in the region. Most important are ideas that one gets out of the survey, and an opportunity to know what the citizens expect.

CHAPTER IV

DEMOGRAPHIC AND LAND USE INVENTORIES

In determining a region's transit needs, the planner must begin by identifying the demographic and socio-economic characteristics of the area's present demography and its socio-economy.

An inventory of a region's demographic profile will help locate potential transit markets by determining the characteristics that are known both to influence transit use and to differentiate the demand for alternative transit service characteristics. The inventory of land use characteristics would also result in a profile of a region's major activity centers and land use development patterns. The type and concentration of land use exerts substantial influence on tripmaking activity.

The geographic location of a person's home in relation to the location of his needs and wants, influences how he would get from one to the other. Also, it has been proved repeatedly that personal income determines tripmaking activity and also different travel needs.[28] In short, transit demand is a function of land use and socio-economic characteristics of a region.

For regional transit planning purposes the following population studies would be needed: information on population trends, family income, automobile ownership, and transportation needs of captive and potential riders. Most of these inventories can be prepared using readily available sources of data and many can be extracted from already prepared planning

studies for regions. These inventories can consist of a brief listing of characteristics in simple tables and maps. Significant amounts of time, money, and effort need not be spent on data collection of this data.

Population Requirements

A. The regional population size and density.

The total population indicates the number of people the planner is dealing with. The size and density of a regional population determines the level of demand for future facilities and serves as indicies of most urban and regional problems. When a time element is introduced and future trends in population density are estimated, these trends become the basis for estimating future growth and future transit demand.

A table on this element of the population study should indicate absolute population of counties and cities in the region, at least showing a trend of a decade back from whatever base year the studies assume. Also, a short term population trend may be necessary. It may indicate growth or decline and will have an influence on transit demand estimation. For example, if 1970 is chosen as the base year for the planning studies, a 1960 to 1970 population change would be needed. Also a percent change in population from 1970 to 1977, and the present population of 1977. Additionally, the 1970 population, area in square miles and persons per square miles should be known for each county.

B. Stratification of regional population by concentration, rural and urban.

This inventory will identify population concentrations and most likely reveal different travel behaviors from less dense areas. A stratification based on number of persons will classify places of over 2,500 inhabitants (U.S. Bureau of the Census definition) as urban area and less than that as rural. Urban areas are known to have order services and facilities, therefore, residents in the urban catchment area, travel to these areas to obtain services. Identifying these areas will give a reflection of where trips are attracted to and generated from.

The inventory should present for each county in the region the number of rural residents, the percent of total population that is urban and the total number of urban residents.

C. Population distribution by age.

There is correlation between transit users and residents who cannot afford to or are not able to operate a vehicle.[29] The elderly (especially those over the age of 65) and the young (especially those below driving age) represent two groups whose mobility is restricted and could be improved significantly by the availability of transit service. In addition, tripmaking characteristics and attitudes of transit service vary for different age groups and both of these factors are important when planning transit initiation or expansion.

D. Income distribution of residents.

Low income people have often been included in the profile of car-less or mobility restricted people. They often cannot afford the operation of a

vehicle. This sometimes makes it hard for them to reach employment centers. Transit development is ancilliary to enhancing economic conditions of low income recipients. Therefore, inventorying those residents is necessary to take care of all those who might need transportation. The Resource Management Corporation studied five rural areas and found out that the poor in rural America make only 15 percent of the trips that the average American makes.[30]

E. Other inventories - auto and telephone ownership.

Residents without autos in the region are likely to be transit dependents. If the density of the area is low, the possibility of available regular public transportation service is scarce, the low density makes walking impossible and neighbors would be so far apart that a non-auto family cannot seek rides from them. This problem is reinforced if the non-auto family does not have a telephone.

Handicapped - These are people in the region who, due to physical or mental impairments, cannot use or operate any conventional mode of transportation. Among this category of residents are the blind, mentally disabled, orthopedic, etc. These residents must rely on relatives, friends, or other forms of specialized transit to meet their mobility requirements.

Source

Various sources can or will produce the data required above for our population inventory. However, what the researcher looks for in a data base are those sources that specifically identify all the elements described above and also contain historical trend data and provide high sample rates.

The fifth count of 1970 population census provides the socio-economic information needed for this type of transit planning. The data is broken down by the following geographical divisions:

State
County
Standard Metropolitan Statistical Area
Minor Civil Division
Place

These counts are on tape and available at the state agency in charge of state planning and development, for example, the State Planning and Research Division of the Department of Administration in Topeka keep these records for the State of Kansas. Several social welfare data bases are also recommended to update the information obtained from the Census Bureau. Specifically, information relative to the socio-economic and travel characteristics of welfare recipients are available with agencies that administer those programs, e.g., the Social Rehabilitation Service in Topeka, Kansas.

There are other agencies like commerce commissions, revenue departments, college extension services, etc., that have valuable information in their publications and records which are useful in this type of planning exercise.

Land Use and Activity Centers

This part of the exercise will deal with major land uses and sub-uses which generate trips and also identify broad travel patterns of the region; public facilities and service activity centers which are used by residents in the area, also major employment and recreational areas within the region.

Land use inventory is an integral part and, in fact, the basis of the process. The extent and pattern of the trip-making activities within an area are influenced by the location of different types of land use developments. The very heart of transportation planning is concerned with the design of circulation systems which maximize accessibility for essential movements between linked activities, giving due consideration to safety, comfort, and amenity as well as cost.[31] The main aim of transit planning is to get people to and from some destination point. This destination is obviously within some category of land use classification, and must be identified. Inventory of land use elements such as trip generators (residential) and trip attractions (industrial, commercial, etc.) assist in identifying opportunities for transit services. Anticipated changes in the destination of land use can influence the appropriateness of various transit alternatives, conversely, if specific land use trends are being encouraged, specific transit service alternative may implement these trends.

To design routes for efficient use of transit systems, the design should correlate with the location of important centers of activities, for example, concentration of office space, retail areas, clinics, etc. These types of land use activities also determine the type and mode of transit system. Essentially, as land use activities are used as the basis of estimating trip demand, they do directly influence model choice. Implicit in the foregoing statements is the inverse assertion that peak demand of public transportation bear a direct relationship with the location of activity centers. For example,

there would be a higher demand for home to work trips between 6:30 a. m. to 8:30 a. m. than medical or any other trip purpose. Elements of this section to be inventoried are as follows:

1. A general description of the region,
    a. Location and physical features of the region,
    b. Historical development of public transportation within the region,
    c. General identification of unique economic characteristics of the region.
2. Distribution of land by categories of land use classification,
3. Location of important centers of activity,
    a. Regional service centers, civic and commercial,
    b. Medical services,
    c. Concentration of office space,
    d. Major employment centers,
    e. Nutrition centers,
    f. Other trip attractions.

Collectively, each of the above variables make a contribution toward a total composite picture of transportation need of the region. For example, low population density makes the likelihood of regular public transportation service slim, makes walking impossible and neighbors would be so far apart that a non-auto family cannot seek rides from them. This later problem would be reinforced if the non-auto family does not have a telephone. The percentage of the population 65 and above and also the

number of handicaps in the region would be a reflection of the extent to which special kinds of transportation facilities might be necessary. The percentage of households with income below the poverty level is a reflection of the difficulty that population segment might be facing in paying for transportation services.

TABLE 1

SUBREGIONAL TRANSIT DEVELOPMENT
PLAN, RILEY & GEARY COUNTIES
POPULATION CHARATERISTICS

SUB-REGIONAL COUNTIES	RILEY	GEARY	TOTAL FOR SUB REGION
AREA SQ. ML.	597	374	971
1960 POPULATION	41914	28779	70693
1970 POPULATION	56788	28111	84899
1976 POPULATION	41799	25058	66857
1970 POP DENSITY	95.1	75.2	85.2
TOTAL RURAL POP	14822	7196	22018
% URBAN POP.	83.9	74.4	7[illegible].2
HANDICAPPED	3279	1640	4919
LOW INCOME (NOT ELDERLY)	6342	2950	9292
ELDERLY (65 +)	3059	1781	4840
TOTAL RESTRICTED MOBILITY	12680	6371	19051
POP DISTRIBUTION BY AGE			
UNDER 5	4113	2540	6653
5 – 9	3866	2092	5958
10 – 14	3453	2242	5695
15 – 19	8004	2741	10745
20 – 24	17620	6899	24519
25 – 29	4691	2148	6839
30 – 34	2542	1334	3876
35 – 39	2057	1261	3318
40 – 44	1847	1276	3123
45 – 49	1653	1178	2831
50 – 54	1452	1064	2516
55 – 59	1281	814	2095
60 – 64	1150	741	1891
OVER 65	3059	1781	4840
PERCENTAGE OF HOUSEHOLDS WITHOUT AUTO	11%	18%	14.5%
PERCENTAGE OF HOUSEHOLDS WITHOUT TELEPHONE	11%	21%	16%
TOTAL NUMBER OF MILITARY PERSONNEL RESIDING 1977	1680 (Manhattan & Ogden)	2261 (Junction City)	4100
TOTAL NUMBER OF STUDENTS RESIDING OFF CAMPUS (1977)	2043		
TOTAL NUMBER OF STAFF AT KANSAS STATE	2140		

Source: 1970 Population Census

CHAPTER V

INVENTORY OF EXISTING TRANSIT SERVICES

Introduction

So far we have been concerned with "tooling-up" studies which provide a perspective of a planning region. We now turn to the activities that go on in the region, especially those concerned with public transportation.

Attention here is directed towards identifying all forms of transit service in the subregion, including taxi services, fixed route buses, intra and interstate buses that serve the subregion and special transportation services for the elderly and the handicapped. This inventory together with the "tooling-up" studies, forms the basis for asserting the need for new or expanded services.

This chapter will indicate certain items that should be inventoried on existing transit services, "why" and "how." The major inventory is as follows:

1. Types of existing transit services,
2. Characteristics of existing transit services,
3. Operating statistics,
4. Supportive hard and soft ware,
5. Administrative characteristics,
6. Financial characteristics,
7. Laws, regulations and ordinances affecting the operation of existing services,

8. Demand characteristics of existing services,

9. Other commercial characteristics.

Types of Existing Services

There are two broad types of transit service with various modes, shapes and sizes; these are, (1) demand responsive, and (2) fixed route, fixed schedule. Demand responsive transportation is described as the flexible routing and scheduling of transportation service on demand. Usually demand responsive services are equipped with radio or telephone facilities, making it possible for service users to call to obtain services. This system made operators name the service "dial-a-ride" or "hail-a-ride." The most common type of this system is taxi service.

Fixed route, fixed schedule operation describes the traditional transit service operated in urban and rural areas and the long distance intra and interstate bus services.

These types of transit service include: regular bus service, express bus service, taxi, charter bus service and specialized transportation services for the elderly and handicapped. What type of services are available in a community and how they operate, should be documented to guide the planner in what alternatives to propose as to certain types of operations which will omit certain conditions.

Characteristics of Existing Transit Services

This inventory is prepared to identify specific supply characteristics

of available transit systems within the subregion. Elements that are usually covered include the following:

a. eligible users,

b. fares (level and method of payment),

c. how one can obtain service,

d. the destinations served,

e. period of operation (hours and days),

f. schedules and type of reservation,

g. routes (diagram if possible),

h. service areas.

Also, those characteristics of transit systems such as "means of access" to service, that is if the service is providing door to door, "park 'n ride" or some other unique characteristic, need to be known. It might be necessary to find out if those services offer shared, group or single passenger rides.

To suggest improvements and coordination of existing services, the basic characteristics of the services should be documented. Details of this inventory would suggest areas needing improvements. Being aware of where services are presently offered would avoid proposing duplicate service. Also an idea about who are presently being served with some form of transportation (eligible riders) will narrow areas of concentration. Similarly, refined details such as fare structure, reservation procedure and hours of operations will offer opportunities and basis for

recommendations and changes aimed at improving existing services to meet overall transit needs of the region.

In summary, this basic information coupled with the "tooling-up" studies provides the elements for analysis, evaluation and recommendation.

Operating Statistics

The elements needed to measure the efficiency of a transit service are the operating statistics among other variables. An inventory of operations statistics of transit services should try to cover:

a. the number of vehicles the agency is operating,

b. the average number of vehicle hours operated per day,

c. average number of vehicle miles per day or month.

Supportive Soft and Hardware

These are the equipment and facilities of the transit services such as offices, maintenance, vehicle storage, dispatching facilities, etc. Also, the general characteristics of the vehicles, i.e., type of vehicle, age, seating capacity, owner, etc.

Administrative Characteristics of Existing Transit Services

Under this inventory an identification should be made of the internal and external administrative structures connected with the transit systems, such as who the sponsors are, funding sources, who is operating the transit service, and also the internal managerial staff, their qualifications, total number and salaries.

This information will offer the planner the means to analyze administrative systems for probable reorganization. Sources of funding and subsidy will reveal potential areas for investigation and recommendation. Administrative characteristics undoubtedly play a major role in shaping the character of the services and, therefore, must be identified.

Financial Characteristics

This inventory covers capital costs, operating expenses and operating revenues of transit agency. Capital costs in terms of public transportation will be the expenditures incurred by the operating agency for the purchase of vehicles, office equipment, communication equipment and buildings.

Operating costs are defined here in accordance with the "aggregate cost concepts" and include the following cost items:

Equipment, maintenance and garage (if rented),

Administrative costs,

Advertising,

Insurance,

Operating taxes and licenses,

Depreciation,

Running costs, etc.

Operating revenue is what fare boxes bring in to the coffers of the transit agency, plus all contributions, subsidies and income accrued from advertising on the agency's vehicles.

This information will provide for the basis of determining the financial stability of existing transit operations, so that possible recommendations could be made.

Many social service agencies have very little idea as to the financial stability of existing transit operations, so that possible recommendations could be made.

Many social service agencies have very little idea as to the financial characteristic of their programs, and an innovative coordination of services has been fought from the standpoint of economic feasibility. The major advantages that are obtained from coordination of transit services are efficiency and cost effectiveness, so if coordination of services is proposed, then detailed presentation of financial data and analysis is necessary.

Laws, Regulation, Ordinances Affecting Existing Transit Service

There are many regulatory impacts on the delivery of transportation services, especially those laws of corporation commissions and state and local governments. These instruments are usually founded on a variety of issues and problems and resolved with some assumptions.

Some concerns and controversies have arisen as to whether some of the instruments of transportation regulatory agencies have negative and/or positive impacts on the service delivery systems they regulate. The planner should identify these instruments, investigate and make necessary policy change proposals where possible.

Under this inventory, identification should be made of relevant Interstate Commerce Commission regulations affecting transit services in the region. Also, some attempts should be made to review the following regulations where applicable:

1. State Corporation Commission regulations,
2. Taxicab ordinances of cities within the region,
3. Jitney ordinances,
4. State and local laws on taxation and bonding authority,
5. Federal laws and regulations,
6. State and local laws relative to ownership, standards and operation and delivery of goods intended for public purposes.

Other Factors

Insurance, transit labor contracts and license requirements may be factors that influence the design, operation and financial obligation of transit services. For example, the type of clientele and frequency of transit service availability will reflect insurance premiums paid by transit service operators.

Demand Characteristics

For the purpose of getting the necessary inputs into projection models, some basic characteristics of the existing transit services should be inventoried. Also, to determine the proportion of the transit market being met presently so that plans can be made to meet the unmet needs, the following elements may need to be known:

a. Minimal profile of riders, e.g., age, income, etc.,

b. Major trip purpose and when most of these trips are made,

c. Total ridership statistics, i.e., annual ridership, average weekday ridership and peak ridership.

A collation of this data and the total number of the restricted mobility group under "population characteristics" should help identify areas that existing transit services are not serving. The total number of transit dependents to be classified as potential riders and the comparison will also provide a measure of the capacity of the existing transit services to handle the transit market.

Sources of Data

A review of the data requirements under this section of the model suggests the areas to locate these requirements. Secondary sources will furnish the needed information under some inventory items, but literature review and review of records of government and quasi-government agencies would be the most probable areas to locate such information. As it has been the experience of most researchers in the subject matter, transit agencies barely keep records of any useful detail for analysis and planning purposes. Therefore, the best estimation should be made in areas where data is hard to come by.

Most agencies providing transportation under licenses from corporation commissions are required by law to submit operation statistics including revenue to the commissions at the end of every year.[32] This is

a valuable data source which should be utilized. Also the transit agencies that receive federal and state funding are required to do some reporting to the administrating agency of the funds. Such information is available and could be utilized.

The process used in this model is to start with a survey. A written brief or questionnaire was mailed to all transit agencies identified earlier. The survey called "Transportation Service Information Survey" (See Appendix C) contains almost all the data requirements discussed earlier. There were some inventory items such as laws, regulations, ordinances influencing existing or potential transit services that were excluded from the brief. Items such as this are best obtained from records of agencies regulating and imitating those laws and ordinances.

Information obtained through this survey are compared and supplemented with those from secondary sources. Operating schedules of interstate commercial buses can be extracted from the recent edition of Russell's Motor Coach Guide.

To demonstrate the identification and analysis of transit service characteristics, a transportation services information survey is administered to one transit agency in the subregion. The analysis and a report is presented following the survey. Also the characteristics of the interstate bus company were compiled as required in the planning process. (See Appendix C.) Relevant law and regulations concerning the operation and management of transit services in the subregion are summarized below:

FEDERAL REGULATION

The Interstate Commerce Act (49 USC 303) 1977, as Amended

The Interstate Commerce Commission (KCC) has the authority to regulate all persons who engage in any for-hire transportation business by motor vehicle in interstate commerce. The ICC requires that such carriers apply for a certificate or permit (49 USC 303(c)).*

ICC regulations do not apply to school buses, taxicabs, the transportation of passengers in interstate commerce wholly within a zone adjacent to and commercially a part of any municipality or municipalities, and casual, occasional or reciprocal transportation of passengers in interstate commerce for compensation by any person not engaged in transportation by motor vehicle as a regular business (49 USC 303(b)).

Except for interstate commercial bus lines operating across the subregion, no transit service is likely to be subject to ICC regulation or permit in the study area.

KANSAS MOTOR CARRIER REGULATIONS
(KSA 66-101)

Corporation Commission Regulatory Authority

In Kansas, the Kansas Corporation Commission (KCC or commission) has the power, authority and duty to license, supervise and regulate every public motor carrier of property or of passengers in the state; to fix and approve of rates; to regulate and supervise accounts, schedules, and service; to prescribe a uniform system of accounts; to require the filing

*This refers to Volume 49 of United States Codes, section 303, subsection c.

of reports and other data; and to supervise and regulate public motor carriers of property and passengers in all matters affecting the relationship between such carriers and the traveling and shipping public (KSA 66-1112).*

Application of Statute

Generally -- The commission regulates both public motor carriers of passengers and contract motor carriers of passengers. A public motor carrier of passengers is "any person who holds himself out to the public as willing to undertake for hire to transport by motor vehicle, from place to place, persons who may choose to employ him." A contract motor carrier of passengers is "any person engaged in the transportation by motor vehicle of persons for hire and not included in the term 'public motor carrier of passengers' as herein before defined." (KSA 66-1108).

Pools -- Pools that are comprised of not more than twelve adults who agree to share all actual costs of operation without intent to make a profit are exempt from Kansas SCC regulations (KSA 66-1109(k)).

Subscription Service -- Employee sponsored vanpools with a capacity of not more than twelve persons who commute to the same place of work are exempt from SCC regulation as long as no individual/firm operates in excess of one vehicle (KSA 66-1109(k)). A subscription van service or bus service with a capacity in excess of twelve persons, or the operation in excess of one vehicle would constitute contract carriage.

Taxicabs -- Taxicabs are not specifically excluded from state regulation, but would be exempt from SCC regulation as long as they operated

* This refers to Kansas Statutes Annotated, Chapter 66, Article 11, Section 12.

"wholly within corporate limits of a city, between contiguous cities, or between a city and suburban territory within three miles of the corporate limit" (KSA 66-1109).

Dial-A-Ride -- Dial-a-ride would also be exempt if it operated wholly within a city, between contiguous cities, or within three miles of a city as long as it did not operate on a regular route and time schedule KSA 66-1109). In addition, dial-a-ride operated by "schools, colleges, universities, religious or charitable organizations and institutions" would be exempt from SCC regulation under a broad interpretation by KCC staff of KSA 66-1109(d)(2). Exemption also applies to motor vehicles operated by or under contract to "the United States, District of Columbia, or any state, or any municipality, or any other political subdivision of this state" (KSA 66-1109(j)).

Thus it would appear that through the current broad interpretation of existing statutes, few dial-a-ride services would come under KCC regulation in Kansas. Major determinants are the service area (within a municipality); the nature of the service (no regular route or schedule); and the nature of the provider (religious or charitable organization or governmental body).

Jitney Service -- Jitney service doesn't appear to be directly addressed in Kansas statutes. However, jitney service would not appear to fit any of the exemptions in KSA 66-1109 and would fall under the definition of public motor carrier or passengers, and be regulated by the KCC as such, but if it operates as a regular taxi service then it will be regulated by the city's ordinance where it is operating.

Application Process and Requirements

Intrastate Public and Contract Carriers -- It is unlawful for any public motor carrier to operate without first obtaining a certificate of convenience and necessity from the commission (KSA 66-1114). It is unlawful for any contract motor carrier to operate without first obtaining a license or permit from the commission (KSA 66-1115). The commission prescribes the form of applications for certificates, permits and licenses. There is a $25 application fee for public carriers and a $10 application fee for contract carriers.

Upon the filing of the proper application forms, the commission sets a time and place for a hearing. The hearing must be held not less than twenty nor more than thirty days after the application is filed. A copy of the application and notice of hearing must be served at least ten days before the hearing upon an officer or owner of every carrier that is operating or has applied for authority to operate in the territory the applicant proposes to serve. Testimony may be offered by any such interested party at the hearing. If the commission finds that there is a need for the service and that the need is not presently being served, the commission will grant authority to operate (KSA 66-1114).

If a properly supported application for operating authority is made and proper notice of the application is given to all interested parties and no protests are lodged, then the commission need not hold a hearing (KSA 66-1115a).

The entire application process, including a hearing, can take from 20-60 days. A temporary permit, good for 60 days, can be granted by the commission upon showing of an immediate and urgent need for service, for example, a political convention in Kansas City with some participants living in Topeka will demonstrate such a need. Temporary authority generally can be obtained in several days and requires a personal appearance at the commission offices in Topeka, Kansas.

Interstate Public and Contract Carriers -- It is illegal to operate as a public or contract carrier in interstate commerce within the state of Kansas without having furnished the corporation commission ownership and operating information (KSA 66-116). It is illegal to operate as a contract carrier in interstate commerce within the state of Kansas without having obtained from the commission a license or permit.

A permit will be issued upon receipt of ownership and operating information (KSA 66-1115),

Licensing Requirements

All passenger vehicles used to transport persons for hire, except those exempt under the provisions of KSA 66-1109, must annually pay a regulatory fee of $10 for each vehicle. The fee is due January 1, and payable not later than January 15 by motor carriers then operating. Upon receipt of the application and fee, the commission shall issue to the carrier a plate for each vehicle registered (KSA 66-1139).

Insurance Requirements

No certificate, permit or license will be issued until the applicant has filed with the commission a liability insurance policy in a sum deemed

reasonable by the commission but not less than $25,000 for personal injury to one person in any one accident, $50,000 for personal injury to more than one person in any one accident, and $5,000 for loss to property of others in any one accident (KSA 66-1128).

KANSAS MOTOR VEHICLE REGISTRATION AND DRIVER'S LICENSE REGULATIONS (KSA 8-127)

Motor Vehicle Registration

Every motor vehicle operated on any highway in the state must be registered (KSA 127(a)). However, school buses and vehicles owned by the state or any civil subdivisions are exempt from this registration requirement (KSA 8-128). For the purpose of motor vehicle registration, a passenger vehicle is defined as "a motor vehicle which is used for the transportation or delivery of freight and merchandise or more than ten passengers." A truck is defined as "a motor vehicle which is used for the transportation or delivery of freight and merchandise or more than ten passengers."

The registration fee for passenger vehicles is calculated by gross weight. The following fees currently apply:

Weight	Annual Fee
3,000 lbs. or less	$ 13.00
More than 3,000 but less than 4,000 lbs.	16.25
4,000 to 4,500 lbs.	19.50
More than 4,500 lbs.	26.00

The registration fee for trucks is also calculated by weight. The annual fee for trucks weighing 12,000 lbs. or less is $27.50.

Any truck registered in a state other than Kansas and engaged in interstate movements within Kansas must have a Kansas registration, unless it is registered under the fleet registration provisions of KSA 8-1499 or entitled to engage in interstate movements within the state of Kansas under any interstate contract agreements, arrangements or declaration made by the Director of Vehicles.

All applications for motor vehicle registration should be made to the relevant county courthouse.

Driver's License Regulations

A Class "C" license is required for operators of passenger cars and vehicles of not more than 24,000 lbs. with a 10-passenger capacity or less. A Class "B" license is required for operators of vehicles over 24,000 lbs. and/or vehicles with greater than 10-passenger capacity (KSA 8-234b). No additional licenses may be required by any civil subdivision, except that cities may require an additional license for persons who drive taxicabs or municipally franchised transit systems for hire (KSA 8-235).

All state license exams cost $3.00 and Class "C" licenses cost $6.00 for four years while Class "B" licenses cost $10.00 for four years.

All applications for driver's licenses should be made to the local Drivers License Examiner's Office.

CHAPTER VI

ESTIMATING DEMAND FOR A TRANSIT MARKET

The core of any transit planning process is trying to measure how many people will use a transit service if it is initiated or improved. Most planning documents may develop the basic groundwork of implementing transportation services but will side step the question of implementation. Frequently such reports statistically describe the population groups living in the service area and nothing more.[33]

Demand for public transportation is defined here as the number and length of trips that may be taken on public transportation services by residents in a region at a given level of fare and level of service. A quantitative evaluation of this demand estimation is necessary to estimate the number of people who need transit and are not now served, to ascertain the potential ridership response which will provide the basis for estimating the revenues and costs of alternative services.

Various approaches have been employed in estimating latent demand in non-metropolitan areas and they do represent a very significant advancement in terms of transit planning in non-metropolitan areas. One common fact which is agreed upon by the proponents is that aggregated models used in metropolitan areas are inapplicable in non-metropolitan areas.

There are three major approaches presently employed in estimating transit demand:

a. A ridership survey,

b. A demonstration program,

c. The use of aggregated travel behavioral models.

A ridership survey is usually administered on an identified potential transit market segment of the population. The major question posed in such surveys is, "Would you use a transit service if it were provided or an existing one improved?" Implicit in this question are other sub-programs that respondents are required to answer, e.g.,

- o trip purpose
- o evaluation of existing services, from the perception of a potential rider
- o route design and pickup points
- o fare structure, etc.

Analysis of these questionnaires will provide the necessary information for estimating demand for transportation and provide answers to the sub-program questions which make routing an easy process for the planner. However, this procedure has been described by some planners as cumbersome, time wasting and costly. The author recommends this approach when feasible because of the convenience it offers in terms of data availability, lesser computations and the needed citizen input in any planning process affecting residents and their tax dollars. It must be pointed out here that this approach may need to be supplemented by other methods. It has been the experience in areas where this approach has been used that results of the survey do not

translate themselves to actuality when systems are implemented using the interpretation of the responses. See below for administration and analysis of a similar survey conducted on a pilot basis in the study area.

Demonstration Programs

To measure the need and characteristics of transit services, demonstration programs have been carried on in some areas to provide the necessary information needed in estimating these requirements. A good example is FHWA's Rural Public Transportation Demonstration Program, Section 147. Among several results expected from this program would be the necessary information to estimate potential demand in demonstration regions.

This approach is obviously not feasible for a small scale planning area such as the one considered here. Time and money do not allow local decision-makers to participate in such a "try and error" approach just to gauge how many people would use a local transit system if initiated or improved.

Models

There are five major models that have been developed to estimate need or demand for transportation services. These models are:[34]

1. Gap Analysis
2. Aggregated Estimates
3. Simulation
4. Subjective Models
5. Burkhardt/Lago Models.

1. Gap Analysis

Yukabousky and Politano in their report, "Latent Travel Demand for Elderly, Youth and Low-Income Population,"[35] used gap analysis to calculate latent demand based on the difference between the daily trip rates of individuals in auto-owning families with rates of individuals in auto-less families. The families were virtually all from the same socio-economic background. Therefore, the approach has the benefit of comparing trip making behavior of groups that are similar except for auto ownership (e.g., auto-owners elderly versus auto-less elderly). This gives the measurement of "gap" or latent demand which needs to be met.

This approach suffers the defect of assuming that the difference, i.e., the gap, should all be met and therefore does not take into consideration trips that would not be taken by the auto-less and those that would. In other words, there is the assumption that people using transit service will travel at almost the same rate as those with autos, which is not necessarily true.

2. Aggregated Estimates

This method focuses on actual measures of the number of trips taken on existing rural public transit systems. A rule of thumb which is applied to this rule assumes that transit trips account for five percent of all trip making in an area.

Jon Burkhardt and W. Millar,[36] in their paper, "Estimating the Cost of Providing Rural Transportation Service" compare two kinds of

aggregate measures, one for the population as a whole and one focusing on "captive riders" of transit systems. Possible ranges of tripmaking for both kinds of aggregates were developed from actual ridership figures of existing transit systems. Two estimates emerged out of this research, low and high estimates. The lower estimate ranged from 0.3 to 2.4 trips per capita per year for the general population in rural areas and 0.6 to 4.0 in small urban areas. The averages of 1.025 and 2.18 annual rides per capita were used to project the total potential annual transit trips.

Popper, Notess and Zappata[37] used similar procedures to develop the following model:

$$D = a \times A \times P$$

where D = demand estimate in the region (annual transit trips)
a = dimension/ESS design parameter
A = annual average transit trips per capita for similar areas
P = population of the region

Jon Burkhardt applied these estimates in rural Pennsylvania[38] and discovered a great variability with actual performance of the systems he tested, and therefore demonstrated the defects of this approach. The major defect of this approach is the variability that can exist between the spatial and demographic characteristics of case study areas and the planning region. Also the constant, "a," "dimensionless design parameter," is ill-defined in the Popper, et al., approach.[39] However, this approach has the virtue of having with it the behavioral characteristics of riders under similar circumstances.

3. Simulation

This approach is basically applied in metropolitan regions to predict demand. Many researchers have tried to use this approach to predict demand characteristics of systems operating in non-metropolitan areas. However, their work has been hampered by lack of adequate data and there appears to be very little opportunity to verify the results. Robert Bruton, in his publication, "Rural Transit Operations and Management"[40] advances this approach but there is some concern that the probable system designs may (or may not) differ from those used to develop model's coefficients.

4. Subjective Estimation

In this approach estimates of potential riders are assumed as the population of transit dependents living within the corridor. This is purely subjective and it should be realized that no actual estimation has been made at all. The process is quick but the main objective, i.e., estimating potential demand, may not be realized.

5. Burkhardt/Lago Model

Jon E. Burkhardt and Azmando M. Lago prepared a series of models to be used to predict demand for public transportation for fixed route and demand responsive systems. There is Macro (system-wide) estimates and Micro (route) estimates. Both estimates are used, one after the other. These models were developed for rural Pennsylvania and they have been applied in other areas in the United States.[41]

They are presented here as published in the report, "Methods of Predicting Rural Transit Demand.[42]

THE MODELS FOR PREDICTING DEMAND

Fixed-Route Systems

Macro (System-Wide) Estimates

To determine how many persons would be served in this instance, the following model should be used:

(1) $\log RTPASS/M = -0.353 + 0.407 \log BMILES + 0.533 \log FREQ + 0.611 \log RESTRPOP - 0.123 \log COMPBMS$

where RTPASS/M = the number of round-trip passengers per month for the system,

BMILES = the total vehicle miles per month for all the vehicles of the system,

FREQ = the average monthly round-trip frequency of service along the fixed routes of the system (found by dividing the total monthly bus miles by the total round-trip route mileage),[1]

RESTRPOP = the number of persons (in hundreds) living in townships and boroughs along the routes[2]

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[1] The "round-trip route mileage" is defined as the sum of actual physical length of all routes, regardless of the number of times certain portions of the street or road may be duplicated by other routes. One-way route miles are defined as 1/2 of the round trip route miles.

[2] The persons living along the routes comprise the population in townships and boroughs traversed by the routes. Double counting of this population should be avoided in cases where two or more routes operate in the same borough or township.

who can use the system (if there are no restrictions on use, this number is the same as the total population), and

COMPBMS = the sum of the monthly bus miles of all other fixed-route and demand-responsive systems operating in the service area, which may (or may not) coincide with the county.[3]

Micro (Route) Estimates

The following equation should be used:

(2) $\log(\text{OWPASS/DAY}) = 6.344 + 0.697 \log \text{FREQ} - 2.547 \log D + \log PoP_o + \log PoP_d$

where OWPASS/DAY = the number of boarding or one-way passengers per day on the specific route being examined. One-way passengers are approximately twice the number of round-trip passengers.

FREQ = number of round trips on the route per day,

D = round-trip distance, in miles, between the farthest origin point served and the main destination,

PoP_o = population (in hundreds of thousands) of the townships, boroughs and cities traversed by the route on the given day, minus the population of the largest city or township (which is defined as the destination population).

PoP_d = population (in hundreds of thousands) of the largest city or borough traversed by the route on the given day.

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[3] Taxi service is not included in the sum of bus miles for the variable competing bus miles (COMPBMS). The limited available Taxi information was found to be insignificant in the variable and therefore not included.

The micro route model has been developed on a daily basis because the frequencies and even length of routes may change from weekdays to weekends and holidays. In these instances Equation 2 may be used for weekdays and for weekends by separately introducing their respective service attributes into Equation 2.

Monthly one-way passengers may be derived by multiplying the daily figures in Equation 2 by the number of weekdays and the number of Saturdays and Sundays that service is provided. The systems examined operated, on the average, 21.5 days per month. Round-trip passengers can be found by dividing the number of one-way passengers by two.

Fare Correction for Fixed-Route Systems

Since fares did not enter into either the macro or micro equations as a significant variable, a correction factor must be applied to the estimate of demand to determine the effect that a particular fare will have on your expected patronage. The fare correction can be applied to either the macro or micro estimates. The formula is

$$(3) \quad \Delta \text{PASS} = (\text{FARE} - 60) \frac{\text{PASS}}{60} \quad (-0.326)$$

where PASS = the predicted number of round trip passengers from either the macro or micro equations,

FARE = the proposed average round-trip fare in cents you intend to charge each passenger, and

Δ PASS = the change in the predicted number of round-trip passengers attributable to the fare policy.

Demand-Responsive Systems

Macro (System-Wide) Estimates

The following equation should be used:

(4) $\log RTPASS/M = -1.879 + 1.099 \log BMILES - 0.217 \log RESVTIME + 0.194 \log HIPROBPOP$

where RTPASS/M = the number of round trip passengers per month for the system,

BMILES = the total vehicle miles per month for all vehicles of the system,

RESVTIME = the average time in days required between a call for service and the time a vehicle arrives, and

HIPROBPOP = the number of persons in the country (expressed in hundreds) who are the likely users of the system (usually defined as the poor plus the elderly who are not poor, except when there are restrictions on who may use the system; in that case, use the number of such persons.

Fare Correction for Demand-Responsive Systems

The fare correction for demand-responsive systems should be made to the macro estimates of demand, since these will be entered into the equations for the micro estimates. The fare correction formula is

(5) $$\Delta PASS = (FARE-70) \frac{PASS}{70} (-0.1668)$$

where Δ PASS = the change in round trip passengers due to the proposed fare,

FARE = the proposed round-trip fare you intend to charge in cents, and

PASS = the number of monthly round-trip passengers predicted by the macro equation.

Micro (Sector) Estimates: Rural, Out-of-County and Between Cities

There are two micro demand equations for demand-responsive systems. One is for use with systems operating entirely within municipalities, and the other is for all other situations.

For all demand responsive transportation systems serving rural areas (also rural to small urban areas), the following equation should be used:

(6) $\log RTPASS/M = 0.840 + 0.261\ IN + 0.506 \log POTTRIPS - 0.230 \log D$

where RTPASS/M = the number of round-trip passengers per month in that particular sector,

IN = a variable which takes a value of 1 if the origin and destination are in the same county and a value of 0 if they are in different counties,

POTTRIPS = the potential monthly trips in that sector, [1] and

D = round-trip distance, in miles, origin to destination and back to original again.

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[1] This can be expressed as the following equation.

(7) $POTTRIPS = \frac{RTPASS/M}{HIPROBPOP} \sum_k (P_k)(\delta_{ik})(HIPROBPOP_i)$,

where POTTRIPS = the potential monthly trips in that sector,

i = the identification of a particular sector,

RTPASS/M = the number of round-trip passengers per month predicted by the macro equation for the total system,

HIPROBPOP = the total high-probability users of the system,

k = the identification of a particular type of destination,

P_k = the proportion of trips of destination type k,

δ_{ik} = a coefficient that takes a value of 1 if the facilities for performing trips of destination type k are available in the sector, and 0 if they are not. (Because of the nature of the data available, medical and shopping destinations are treated differently than other destination types; they use values other than 0 or 1. (See page 108)

$HIPROBPOP_i$ = the high-probability population of that sector.

Micro (Sector) Estimates: Travel within Small Urban Centers

The equation for predicting travel that occurs entirely within small urban centers (defined as boroughs and cities with population in excess of 1,000 persons) is:

(8) $$RTPASS/M = 0.471 + 2.732\ (POTTRIPS) - 1.710\ (POTTRIPS \times TR)$$

where RTPASS/M = the number of round-trip passengers per month for the small urban area,

POTTRIPS = the potential monthly trips in the urban area, using the above formulation with the high-probability users in the urban area as $HIPROBPOP_i$, and

TR = a value that takes value of 1 if there is any public transit available in the urban area, and 0 if there is not.

Note that this equation is not expressed in logs but in natural numbers.

STEPS IN USING THE MODELS

To apply the models in your particular circumstances, follow these easy steps:

1. Decide whether you are investigating a fixed-route or a demand-responsive system (or both).

2. Collect the relevant data about your local area.

3. Select the relevant operating characteristics from your system.

4. Perform the mathematical computations.

5. Determine the influence of your proposed fare structure on the predicted demands.

6. Apply micro demand models to determine the percentage distribution of the macro demand among the various sectors.

7. Repeat steps 3 through 6, if you wish to test alternative service options.

These models have both advantages and disadvantages. They are quick and easy to apply. The use of computers is not necessary and the data requirements are easy to come by. However, the following concerns are expressed by the author and some colleagues who have utilized this approach to estimate demand for public transportation in Cowley, Ellis and Barton Counties in Kansas.

1. The universal applicability of the constants and coefficients are questionable. These models were developed with greater consideration given to the socio-economic characteristics and operational entities of systems in Pennsylvania. However, the approach demonstrated how these constants and coefficients were derived so the possibility exists for developing such elements for areas of any particular interest.

2. In using this approach to evaluate transit systems in the counties cited above, there were instances of negative demand estimates. Does this mean the systems were doing better than they should, or what? In other words, were our systems exceeding the potential capacity? There is very little means to evaluate or justify the validity of estimates derived by this approach.

3. TR is a value that takes value of 1 if there is any public transportation in the urban area, and 0 if there is none. This was a major weakness

of the model. It was thought that being a competitive factor, a choice determinant element should rather be introduced than an arbitrary constant. While there are many variables that a person should consider in making a choice between services, price was thought of as a strong factor. Therefore, the proportion of fares charged by competing services would be a better factor than the model dictates.

Despite these defects, the models are viewed as good evaluation tools and they are used in this report to evaluate one existing system in the study area.

Other Methods

Other methods exist for estimating transit demand. Only a few of them will be discussed here. It must be said here that most of these methods are metropolitan planning techniques and some modifications are made on them to fit the rural regions.

One of such approaches is, "the systemwide Ridership ty Trip-maker Stratification ART Service." Graphical surveys are developed for age groups, sex and trip purpose in the region. The data for these graphs are extracted from ridership surveys. It was concluded, after applying the procedure in Michigan cities, that this approach is accurate for predicting total weekly ridership.[43]

The following are the detailed steps for applying this procedure:

1. Check that the following conditions are met before the approach is applied:

a. population of area, 5,000 to 20,000;

b. non-availability of other public service;

c. fixed route, or point deviation service.

2. Obtain service area characteristics data such as that defined in Chapter III, but stratify age grouping by sex.
3. Determine the proposed fare structure or alternative fare structures.
4. Estimate weekly trip rates for major trip purposes.
5. Multiply the trip rates for major trip purposes for each category by the population in each category. Sum the total of all trips.
6. Estimate daily ridership.

Application

The author favors the approach of using several methods to estimate the potential ridership within the region. The approach advocated in this model is as follows:

1. Estimate need of public transportation by some objective criteria such as aggregate estimates discussed above.
2. Carry out a potential ridership survey to help in programming and designing network, by the survey administration approach discussed in Chapter III.
3. Utilize Burkhardt/Lago model to estimate the optimum

demand for existing individual services. (If the model indicates that existing services can do better than their present performance, then there is the need for improvement of general operational characteristics of the services to meet respective capacities.)

4. Sum up the optimum demand estimates of individual existing vehicles and compare with figures arrived at on stage one and two above.
5. If the difference in stage four is substantial to warrant initiation of a new service and/or if existing services cannot be modified to suit the standards set earlier, then a new service is justified.

Jon E. Burkhardt and Charles L. Eby in their article, "Need as a Criterion for Public Transportation Planning"[44] outline the following methods to determine need for transportation service:

1. Optimize economic productivity by determining what level of transportation service would have the greatest effect on the regional economy through increases in employment and personal income.
2. Establish through the political process the level of transportation that you consider to be the moral right of a person.
3. Test a hypothetical range of transportation services to determine at what point the benefits of providing the

service outweigh the costs by the greatest amount.

4. The minimum transportation required to achieve social goals is a possible alternative (experts in health, nutrition, employment and training, and other areas establish the minimum level of travel required for each).
5. Use the personal perceptions of the poor as the estimate of need.
6. Run a demonstration project to determine how people would actually behave when the system was actually there and see which of the preceding methods comes closest to predicting the actual use.

Any of the above methods can be used to measure the need for transportation. Whatever method is used, it is important to stratify trips into required and discretionary categories. Required trips are defined to be those that are highly income inelastic, that is, they will be taken almost irrespective of their price. Discretionary trips are those that will be deferred as their price.[44]

In estimating "need" in the subregion, 2.18 trip rate was used. This trip rate was adapted from the aggregated approach discussed on page 79. These figures represent total annual trips expected to be made by the different categories of people in the report.

From the population characteristics of the subregion, it was determined that 19,051 residents are considered transit dependent. Using a

"need criteria" it can be assumed that 40,531 round trips would be made per annum. This is computed as 19,051 times 2.18 annual trips. Two trips per annum was the national average computed for mobility restricted people as presented under aggregated estimates above. The ideal situation is to use state estimates for various categories of the mobility restricted residents, i.e., the elderly, handicapped and low-income recipients.

A potential ridership survey was used in this stage of the model to estimate work and school trips of military personnel, students and staff of Kansas State University. The travel behavior of the groups of people would be hard to predict because of the unique characteristics such groups exhibit under different conditions. Hence, national or state averages would not be effective in measuring their need for public transportation. The approach to utilize in such situations, in this author's opinion, is to measure their need directly from those concerned, i.e., administering a Potential Ridership Survey. One other point that supports administering a survey is that most of these people own vehicles and/or can operate them unlike mobility restricted people. So any assumption for them would not hold.

Analysis of the pilot survey carried out in this study revealed the following number of people in the groups below might use public transportation if initiated or improved.

Military Personnel	35%
K. S. U. Staff	37%
K. S. U. Students	58%
Other	5%

The major trip purpose was work and school. If these percentages are factored by the total population of each group in the subregion, it is expected that:

$$(0.35 \times 4,100 \times 5) = 7,175$$

round trips might be made by military personnel in the subregion. Similarly, K. S. U. staff will make 3,959 round trips and the students are also expected, according to the survey to make 5,925 trips in a week.

In other words, the total trips expected to be made by the restricted mobility, students, military personnel, and K. S. U. staff is 17,839.

This figure represents a 5-day week potential ridership in the subregion. To obtain estimates for Saturday and Sunday, only estimates from the restricted mobility groups are considered. According to the theory of systemwide ridership by tripmaker stratification, weekend estimates would be 20% of average ridership.

There are certain basic assumptions in the method of approach discussed above. They are:

1. The fare structure is assumed as one that can be afforded by everybody whose tripmaking activity has been estimated. The idea of a system being able to pay for itself from farebox revenue is not advanced in this model. The author shares the view that transit systems cannot break even,

let alone make profit in terms of revenue and operational cost.

2. Trip purpose is not reflected on the estimation of the "need concept". However, it is expected that a further analysis of a complete potential ridership survey which will reflect trip purpose will boost up ridership estimates.
3. That designing a system to meet estimated ridership should be staged. In other words, the system should not be made to meet all the estimates at one time. The first stage should be designed more in terms of a demonstration project which will provide the necessary input (practical against theory) for a total system design.

CHAPTER VII

SERVICE STANDARDS AND EXISTING TRANSIT SERVICE EVALUATION

This stage of the planning process deals with assessing the performance of existing transit services for their efficiency and effectiveness in meeting the transit needs of the region. Information collected in the "tooling up" processes and the internal and external characteristics discussed in previous sections will be the basis for analysis.

This chapter of the model will discuss transportation evaluation theory as it pertains to transit levels of service, and identify and describe a set of operating characteristics to be considered in the measurement of transit performance.

Measuring transit service with the goals and objectives set initially would give the planner an insight into how existing services can meet the goals set for the region. It is apparent that a good system of service objectives complimented with reasonable criteria and standards can point the way towards increased efficiency and the elimination of wasteful practices.

In discussing levels of service and evaluation, one should not lose sight of that large group which is ultimately affected; the public, which includes those who use transit as well as those who do not. If a methodology for evaluation that the layman could understand were made available, perhaps the public could become more involved in regional

transit affairs. This is important, considering the increasing amounts of public monies now becoming available.[45]

Transit service evaluation can also provide transit service agencies the necessary tools for self-assessment. There is the continuous need of operators to know how their operations are faring in terms of the community expectations and values that they serve.

In order to establish valid criteria and to facilitate system information gathering, it goes without saying that comprehensive identification of systems characteristics is inevitable. It is easier and more convenient if uniform data reporting and record keeping have been developed. This is essential for accurate and reliable transit evaluation.[46]

Methods of Evaluation

Various descriptions of the theory of evaluation models have been presented by many researchers. William G. Allen, Jr., and Frank Dicesare summarized these models from a report by the Rand Corporation in their study, Transit Service Evaluation.[47] They indicated that methods of evaluation can be described on the basis of their complexity, technical input and completeness. The following is a general summary of what was presented in the report.

Method 0 - an intuitive judgment of the system's attributes by one or more qualified persons.

Method 1 - utilizes a checklist of all system attributes which are considered significant to all persons involved.

Method 2 - the checklist of attributes plus the corresponding performance measures. Performance measures are physically measurable characteristics which determine system performance with respect to each attribute. The performance measures chosen should be based on their appropriateness to the relevant policy or goal structure.

Method 3 - setting limits on the variation of attribute values. Retain those values that are acceptable, eliminate those that are clearly undesirable or infeasible.

Method 4 - listing of the attributes in order of their importance: a system of priorities.

Method 5 - the complete worth procedure: find independent worth assessments on the different attribute values, determine a set of weights showing the relative importance of the attributes and then compute the total worth as a linearly weighted sum of the worths over the attributes.

Each of these methods is obviously a more complex and refined procedure than those that precede it. Method 0 has been the most commonly used approach in the past, whereas this paper concentrates on Method 2.

In Method 2, mention was made of the fact that it is important to relate performance measurement to a goal structure. Indeed, evaluation

of any kind requires a thorough understanding of what is meant by goals, objectives, standards, and criteria.

Based on the process in which this model is built, it is appropriate to utilize Method 2 discussed above. This method will eliminate personal biases and indicate various components of the existing systems which might need improvement. It is basically evaluated in terms of community goals and objectives, and these were developed with much citizen input. Transit agencies would realize what the society they serve expects out of their operations.

The process of developing goals and objectives was discussed in Chapter II. Attitudinal surveys formed the basis for evolving these objectives and answers to sub-programs concerning transportation issues were also presented which collectively measures the citizens values and expectations.

It was discussed in the same chapter that standards and criteria must be developed to evaluate transit characteristics and alternatives. The judicious use of accepted service standards seems to be the only way to evaluate a single transit system on an absolute basis.[48]

Service Standards and Criteria

This problem of setting standards to evaluate existing transit service is one of the difficult things to do. While parts of this task are quantitative (which may be easily set) the qualitative elements of service standards appear to appeal to the subjective opinion of the planner.

Therefore, it is only reasonable to include fewer qualitative standards to make the evaluation as convenient as possible.

Transit systems planning standards should be developed at higher than "local" levels of planning, especially the quantitative standards. National and state planning agencies have a broader data base and operating systems to draw valid and achievable standards. However, this has been a negligent legitimate responsibility of most state planning agencies.

Based on the experience of Iowa Department of Transportation,[49] it is safe to assume the following in developing service standards for a transit region:

a. That the regional transit needs are not being met despite the performance of existing systems, therefore, improvements are necessary. These improvements can be in terms of capital, marketing or administrative modification. The rationale for this assumption is simply, there is no "the best" system operable anywhere.

b. Regionalization or coordination have the virtue of economics of scale and a subsequent reduction in unit service cost. Thus, standards relative to vehicle utilization, capital cost, or trip cost should be better than existing transit operations.

c. Available funds to implement programs should be the gauge for not setting overtly high expected levels of service.

The major criteria for setting these standards is demand estimation (discussed in the previous chapter). The present performance characteristics of existing transit systems and the total transit needs in the region will in most cases show a deficiency. The underlying question is, then, how much of this regional transit demand must be captured, within the limited sources, and would generally be accepted as an improvement towards meeting our goals?

To answer this and other questions it might help to refer to service standards of some other regions with the same characteristics in terms of density, population size, and similar transit services existing in the planning region and also, the expectations of the residents therein as measured from the results of the "Potential Ridership Survey" discussed earlier would offer the opportunity to modify referenced standards from other regions to suit local conditions. In the survey questionnaire, the major issues needed to evolve transit standards should be included if they cannot be referenced and modified.

Usually transit service standards are defined in terms of such factors as fares, costs, equipment utilization, types of trips and the regularity, reliability and frequency of service, areas and activity centers to be served, routes and frequencies. Therefore, the analysis of the ridership survey would provide the basis for designing transit standards.

Criteria is the measure devised to compare the performance of transit systems and any statistical method applied is generally acceptable.

In most cases a ranking order of the variables can be instituted with the expected captive ridership (demand standard) as the optimum achievement point. For example, if a system is performing 200 trips a month with a 20-seat capacity vehicle and the standard adopted for such system with that potential is 600, a rating score of say between 1 to 4 may be adopted corresponding with the performance, e.g.:

0-199	1	Poor
200-399	2	Fair
400-599	3	Good
600	4	Excellent

In such a rank, our hypothetical system performing 200 trips per month will be doing just fair. Now a cummulation of scores of each characteristic as compared with our standards would give the composite performance of the system evaluated. Also areas of weak characteristics needing improvements to meet our objectives would be identified.

Service Characteristics

Several variables are identified in the preceding chapter but not all these characteristics necessarily need to be evaluated. A modified format developed by Allen and Dicesare[50] describing characteristics worth measuring is used to evaluate a system in the study area. They indicated that this format is not supposed to be a complete listing of every characteristic that could conceivably influence service level and, on the other hand may be too much and therefore some variables are irrelevant. An explanation of the variables are included in Appendix E.

Study Area Transit Service Evaluation and Service Standards

Reviewing reports from areas with similar characteristics as the study area: Chapel Hill, North Carolina;[51] Amhearst, Massachusetts;[52] and Iowa City, Iowa;[53] were identified as having similar (not total) characteristics with the study area. This identification was made in terms of population size, density, other socio-economic characteristics and available transit services within these areas.

Based upon the performance and standards of the existing transit services in the areas mentioned above, the reflections of the pilot Potential Ridership Survey and the goals and objectives recommended earlier in Chapter II, the following service standards are recommended. These service standards are not purported to be absolute and therefore, not necessarily valid. It is expected that if this planning process model is fully carried out, if and when the State of Kansas completes its planning responsibilities in the Section 147 Demonstration Program the validity of the quantitative standards can be verified and revised accordingly.

1. Service

   a. A fixed route service should be provided from residential areas in Junction City and Manhattan of relatively high potential riders (Military Personnel) to Ft. Riley from 6:30 a. m. to 8:30 a. m. and 4:30 p. m. to 6:30 p. m. (return work trip), Monday through Friday.

b. A fixed route service should be provided from residential areas of Manhattan and its immediate environs of higher concentration of students, staff of K-State, and other manufacturing and service industrial employees, to Kansas State University and industrial and commercial zones, from 7:00 a.m. to 6:30 p.m. Mondays through Fridays. Maximum provision of service at early and late service hours indicated above.

c. A demand-responsive service be provided on a 24-hour basis to serve workers on shifts and augment fixed route services, and/or

d. Specialized transit services should be provided for the elderly and handicapped to medical centers, shopping areas and nutrition sites in the whole subregion.

2. Frequency of Access to Activity Centers

Services to all activity centers including job areas in subregions should be made available on a demand-responsive basis at the maximum of 24 hours a day.

3. Degree of Vehicle Accessibility

Vehicles should be accessible to the non-ambulatory (See specifications in Appendix E.)

4. Informational Systems

Schedules of transit services should be published in local

newspapers (weekly). In addition, schedules should be available at community centers, nutrition sites, government offices and popular gathering places.

5. Level of Service to the General Public

The transit service in each category above should emphasize major trip purposes and clientele that the systems were designed for. In the case of integrated use by clients of any of the systems, emphasis should be placed on the prime clients the service is intended to serve.

6. Area Coverage

Persons in all portions of each of the counties in the region should have accessibility to a transit service, at least demand responsive service, if possible.

7. Vehicle Utilization

Every effort should be made to coordinate the various trip needs to vehicle availability in order to fully utilize vehicles and eliminate overlapping under-utilized services.

8. Existing System Utilization

Existing transit operations, both public and private, should be fully utilized, wherever possible, instead of developing additional operations in order to minimize costs.

9. Fare Structure

Access to transit for elderly and handicapped should not be denied because of inability to pay full fare; therefore, a suggested donation ought to be used.

Instead of developing qualitative standards, the specifications developed by the Kansas Department of Transportation to invite bids for supply of vehicles in their 16(b)(2) program is recommended for evaluation. (See Appendix F for a copy.)

Evaluation of Transit Services

Based on the standards set up in the foregoing paragraphs, one existing transit agency, Aging Transportation Agency, in the study area is evaluated to demonstrate this stage of the planning process of the model. A rating score of 1 to 4 is used here as discussed earlier. It is iterated here that some standards needed to evaluate the ATA transit service were not discussed above. They are assumed or included in the forementioned Appendix E.

TABLE 2

TRANSIT SERVICE EVALUATION

Method of Measurement[a]				ATA Transit Agency			
1	2	3	QUANTITY	1	2	3	4
			User				
			Routes				
x	x		route density			x	
x	x		route distribution			x	
x	x		route coverage, area			x	
x	x		route coverage, population				x
x	x		vehicle use		x		
			Frequency				
x			headway			x	
			Capacity				
x	x		vehicle seat capacity				x
			QUALITY				
			User				
			Speed				
x			scheduled speed			x	
			Reliability				
		x	on time performance		x		
			Convenience				
x			route directness			x	
x			hours of service				x
x			information services		x		
x			Special Services Innovation		x		

TABLE 2

TRANSIT SERVICE EVALUATION

Method of Measurement[a]				ATA Transit Agency			
1	2	3	QUALITY (Cont'd)	1	2	3	4
			Non-User				
			System efficiency				
x			equipment utilization		x		
x		x	energy efficiency		x		
			Demand				
x	x		trips per month			x	
x	x		service usage		x		
x			vehicle occupancy		x		
x			seat turnover				x
			COST/REVENUE				
			User				
			Fare				
x			base fare		x		
x			transfer, zone, or reduced fares for special groups	x			
x			fare collection methods	x			
			Non-user				
			Operating economy				
x			operating ratio			x	
x			average fare			x	
x			maintenance costs		x		

[a] The "Method of Measurement" column describes how each characteristic was measured. The key to this chart is as follows:

1. Measured directly from the transit authority (ATA) records or inventoried in the Transit Service Information Survey.
2. Obtained from socio-economic and land use inventory of study area. (Chapter III).
3. Obtained from data and specifications in Appendix D, or assumed or derived.

CHAPTER VIII

FORMULATING AND EVALUATING TRANSIT ALTERNATIVES

This stage of the planning process concerns providing solutions to the transit problems in the community and meeting the needs of the residents. Alternative transit services are a function of the type of hardware used to meet the public transportation needs of the residents in the region. Various technology can be used to provide a variety of service with different elements.

In this chapter an attempt will also be made to demonstrate the evaluation of transit service alternatives. After alternative options have been considered and a choice is made as to what type of service would be implemented to satisfy the transit demand, an analysis of its feasibility may be necessary. This feasibility analysis is nothing but an evaluation of the process of implementation. Evaluation of alternatives are conducted formally and periodically during the implementation phase. The basic structure of the evaluation element does not change, but transit services can change after evaluation.

The basic concern in this phase is, which service option or options would meet the objectives or standards set by the community? Also within the resource capability of the community, which option or options would give a maximum benefit for the dollar.

In this chapter, characteristics of various transit service options will be discussed, with the intention of suggesting options to be considered.

No serious attempt is made here to choose an option for the study area because the tooling process was done on a pilot basis. However, regulations and licensing requirements which may affect the initiation of some transit services in the subregion will be discussed.

The basic methods for evaluating alternative options are also presented in this section of the treatise.

Alternative Transit Services

A study of the general travel behavior in a region will indicate that a single transit service is not likely to meet the transportation needs of the residents. The characteristics of a service may deter some members of the community to use it, and hence ridership would not be as expected from that group. In these situations a variety of options need to be considered to realize the objectives in the community, and could sometimes require the operation of several service options to optimally achieve the communities' objectives.

While the technology or type of vehicle is an important element that influences the choice of an alternate, other considerations are worth considering because consumers of transit services are normally less concerned with transit technology than with the service the technology provides.[54]

The following are the basic transit service alternatives usually operated in non-metropolitan areas:

1. Demand responsive transportation service,

2. Jitney services,

3. Vehicle pools,

4. Fixed-route, fixed-schedule,

5. Express bus service.

1. Demand Responsive Transportation Service

Demand responsive transportation is described as the flexible routing and scheduling of relatively small vehicles to provide personalized door-to-door service on demand. There are many variations of DRT services with various pet names such as dial-a-ride, hail-a-ride, etc.

The most attractive feature of DRT is the convenience of the door-to-door service it offers which makes it possible for the elderly and the physically handicapped to use that type of service. DRT services are normally requested by telephone. Usually vehicles used to offer this type of service are equipped with a two-way radio, so that a dispatcher can relay requests to drivers at any point within the service area. In some cases, reservations would be needed before clients can receive service.

DRT service works efficiently during off-peak periods when the demand for service is lighter and diverse. Also weekends and late evening offers the appropriate time to operate DRT services. This has encouraged operators of DRT services to make them available on a 24-hour basis.

The following are other variations of DRT services that are usually operated in non-metropolitan regions.

a. Shared Ride

This is a concept where riders going to a common destination arrange for one taxicab and split the cost among them. It is becoming popular but the non-common occurance of riders with common origin and destination does hamper the development of this concept.

b. Route Deviations

This is usually an extension of a fixed-route service, where the service vehicle would deviate from their route for a short spell to serve those people. Operators expect advance notice from such people before the service can be instituted.

c. Regular Taxi

The most common type of DRT service is the age-old taxicab operation. In most cities taxicabs offer a 24-hour door-to-door service. They are generally privately owned. However, most cities have been known to subsidize elderly riders paying a substantial portion of fares charged by taxi operators. A local example is the City of Manhattan in the study area. Despite the relatively high fares they usually charge, this taxicab business offers the kind of personalized service people need. Their operations are subject mostly to local regulations as summarized above.

Dial-A-Ride and point deviation DRT services are just other forms of demand-responsive services. These system names are generally descriptive of the basic variation they offer in their operation.

2. Jitney Service

Jitneys are small buses and vans that carry several passengers at once along fixed routes on a variable schedule. They may provide route deviation services if the need be, but such deviations are normally close to designated routes.

Operators of jitney services are usually individual entrepreneurs who own their vehicles. Under some circumstances they form cartels to protect their business and regulate themselves.

Jitney service doesn't appear to be addressed in the Kansas Statutes. However, jitney does not appear to fit any of the exemptions in statutes and would fall under the definition of public motor carrier of passengers, and be regulated by the SCC as such.

3. Vehicle Pools

Vehicle pools come in several varieties: van pools, car pools, bus pools, etc. Vehicle pools offer an arrangement where individuals have common destinations. These individuals usually ride together using one particular person's car and contributing to gas usage, or rotate vehicles by taking turns in driving. In this latter case, individuals use their cars to pick others up and drop them off. This travel option works best when the people forming the pool live close to each other and work at the same place.

Pooling offers several advantages over conventional bus services. Vehicles are not constrained over one route, door-to-door service, few

stops, etc. However, there is the disadvantage that members of a pool will be without transportation before their departure time, if the need arises that they need to go somewhere.

4. Fixed-route, Fixed-service

This describes the familiar transit bus service operated in urban and rural areas and also long-distance intercity bus services. This system is popular because it is usually easy and inexpensive to operate and with convenient sized buses this system can accommodate high volume demand.

The fixed-route system appears to have some disadvantages.

a. Distances people have to walk to catch rides

b. Waiting time for arrival of buses

c. Impersonal service

d. Inefficient use of vehicles during off-peak periods.

These and other variables tend to deter riders from using fixed-route services.

However, cost benefit analysis indicates that fixed-route services can be efficient if high ridership exists and other considerations such as routing, scheduling, etc., are well planned. It should be reiterated here again that these are not the only variations or options of transit service that exist or can be developed. Since transit options are influenced by technology, new inventions in technological fields will bring in new transit concepts.

What is essential in considering alternative transit options to solve

public transportation is not the hardware, but service elements which could involve variations of the systems discussed above.

The transit elements worth considering when trying to make a decision on transit options are:

1. Access to and from the service
2. Service routes
3. Service schedules
4. Transferring or changing modes
5. Vehicle occupancy
6. Manner of requesting service
7. Type of reservation
8. Availability of personal assistance
9. Area coverage
10. Eligible users
11. Hours of operation
12. Days of operation
13. Fare structure
14. Vehicles, etc.

In other words, comparison should be with the standards set earlier which will guide as to what option the planner should look for to meet the needs of the community. Some basic approaches worth considering in meeting these needs are presented in the report, "Selecting and Programming Regional Transit Service Alternatives."[55] They are summarized below.

There are two parts of the transit operation which can be manipulated to meet the service standards that are set:

1. Operations - vehicles and drivers, and the manner in which they are used.
2. The Organizational Structure - staff or overhead people, and facilities.

The new standards will no doubt require changes in operations, e.g.,

- Establishing fixed routes in some areas, or at times of day, where expected demand is heavy enough to warrant a fixed route.
- Starting demand responsive systems in areas, or for clients, that have not previously had service.
- Eliminating overlapping activities of systems which were combined into the region.
- Use of specially equipped vehicles to better serve the handicapped clients.
- Decide what type of service, or combination of services should be provided to meet the new standards.

Estimation should be made of vehicles' and drivers' requirements for new or modified services. Hopefully a substantial portion of any required additional capacity can be obtained through improved vehicle utilization -- one of the benefits of a regional approach to transportation.

Relating routes and vehicles to estimates of rider demand is not yet a foolproof scientific process. Service patterns must be experimented with mentally and on paper, until a way is found to meet one's needs and standards.

Maintenance can be performed under a master contract with private firms to achieve economies of a scale.

Reconstructing of services to eliminate duplication or increase utilization can be done in stages to reduce transition pains.

Statement of the Alternative(s)

Each of the new service and organization structures which are being considered should be put in a clear, concise statement covering its essential features. In sparsely populated regions, or parts of regions, there should be enough vehicles planned to run the miles necessary to get the estimated daily riders to their destination.

Fare Policies

Institution of fares or suggested contributions, or increases in both, should be given serious consideration. Although the concept of public transit is based on deficit spending for transportation to avoid or reduce larger "cost" in other areas, e.g., gas consumption, pollution, highway wear and tear, human suffering; it is incumbent on transit management to demand compensation in the form of a fare or an agency fee where there is some ability to pay.

Changes in Structure

Consideration should be given to opportunities that will reduce cost, as a result of pulling all existing transit systems under one regional organization.

Evaluating Alternative Options

This portion of the model is concerned with the approach to select the "best" alternative. This approach also serves as the basis for continued monitoring and evaluation of option selected and implemented.

This detailed evaluation phase covers area such as cost, demand and objective attainment analysis. Elements of each option would be quantified and compared with each other and against our standards. This will produce a detailed assessment of the relative merits of various transit alternatives.

Monitoring and evaluation of options chosen will deal with the overall management, operation and organizational aspects of the transit service with the aim of reviewing these elements as deemed necessary to meet the objectives of the community.

Several analytical techniques exist for alternatives evaluation including cost benefit ratio, rate of return, return on investment, net present value, etc. Among these methods, cost-effectiveness analysis appears to be the most feasible technique applicable in non-metropolitan areas. Its principal advantage over other techniques is its dependability on the value expressed by the community, i.e., societal objectives. Also this technique involves local participation and leaves judgment in the hands of decision-makers in the community.

Peat Marwick, et al, [56] defines effectiveness and cost as the level of objective attainment and net costs for a complete service respectively.

The graph was produced after quantifying the cost variable using estimated budget of a conceived transit program for the region. Standards are also quantified as defined on the next page to produce the cost-effective graph.

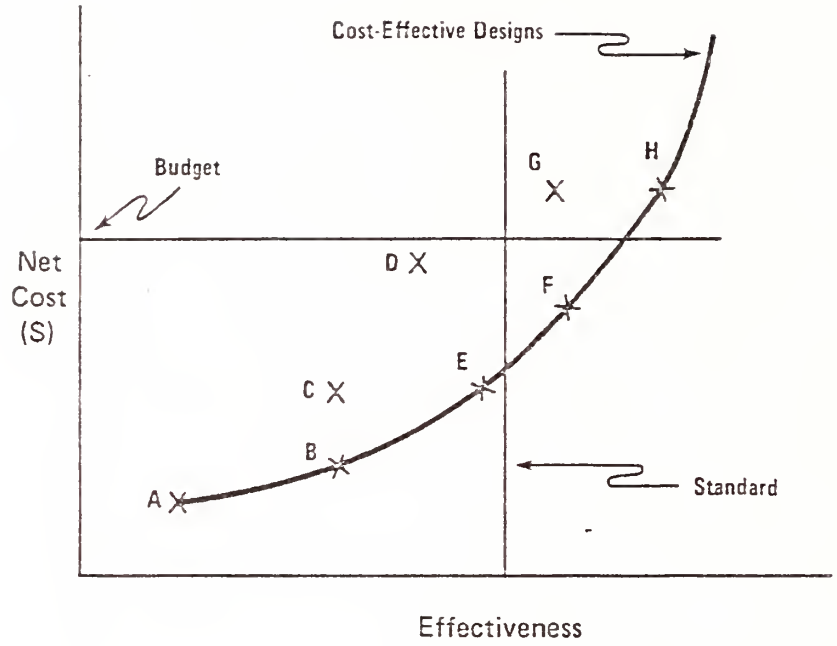
Peat Marwick, et al,[57] discusses this cost-effective analysis as presented here in the next two paragraphs.

The Cost-Effective Graph

The results of a cost-effectiveness analysis can be displayed on a cost-effectiveness graph (See Figure 3). When alternatives are displayed on such a graph, some fundamental relations may be observed. In general certain projects (represented by points C, D, G in Figure 3, are "dominated" by other projects in the sense that they are either more costly than other alternatives that provide the same level of effectiveness (e.g, alternative C compared to alternative B) or less effective than other alternatives that require the same amount of expenditure (or less) (e.g., alternative C compared to alternative E).

By removing the dominated alternatives, a set of cost-effective projects or alternatives can be identified. The best alternative in this group is the one that has the highest level of effectiveness but does not exceed the cost limit or established budget set by the community. In Figure 3, alternative F would be selected because it achieves the highest level of effectiveness within the community's budget for transit service. When a standard of service has been established by the community, that alternative which meets or just exceeds the standard while not exceeding budget limits is selected.

FIGURE 3



COST EFFECTIVENESS GRAPH #1

A detailed quantification of all cost variables would have to be made before producing the above graph. On the question of effectiveness, prioritizing and ranking the objectives and standards would produce variables necessary to measure each option.

Variables of cost of a transit option should include the following items.

Cost of fuel/vehicle/miles/maintenance
Operations Supervision (Dispatchers, etc.)
Maintenance - Vehicle
Marketing and Promotion
General Management
Space Costs
- Rent
- Utilities
- Cleaning and Maintenance

Purchasing
Accounting
Insurance
Taxes and Licenses
Travel
Professional Services; e.g., legal, consulting
Other

Within each function, consider both types of cost which might be incurred:

- Employment; i.e., Salaries, Wages, Benefits, Payroll Taxes

- Support; i.e., any article or service purchased on the outside.

To demonstrate how to quantify and graph effectiveness, the following example is given:

Objective 1. To provide transit services for the transportation disadvantaged in the region.

Objective 2. To provide alternative transportation service to military personnel, students and staff to work and school respectively.

The priority list would place Objective 1 first and therefore let us rank that 10, (assuming we have 10 objectives, then the first priority will get 10 points and the least priority will get 1 point), and if Objective 2 falls, say third, on the priority list then it will be assigned 8 points.

The next step is to quantify the objectives. In other words if the transportation needs of say 80% of our restricted mobility are met, would that constitute meeting our objective? Whatever percentage of our restricted mobility needs we hope to achieve, which should be measured from the reflections of the general attitudes of the community, the criteria should be adequate as far as it uniformly applies to all transit options. Then the quantification can be set out as follows:

Effective Variable	Rank/Weight		Potential Achievement of Alt. 1	of Alt. 2
Obj. 1: Provision of Service to Restricted Mobility	10	x	75%	60%
Obj. 2: Provision of Service to Students, etc.	8	x	60%	55%
			1,230	1,040

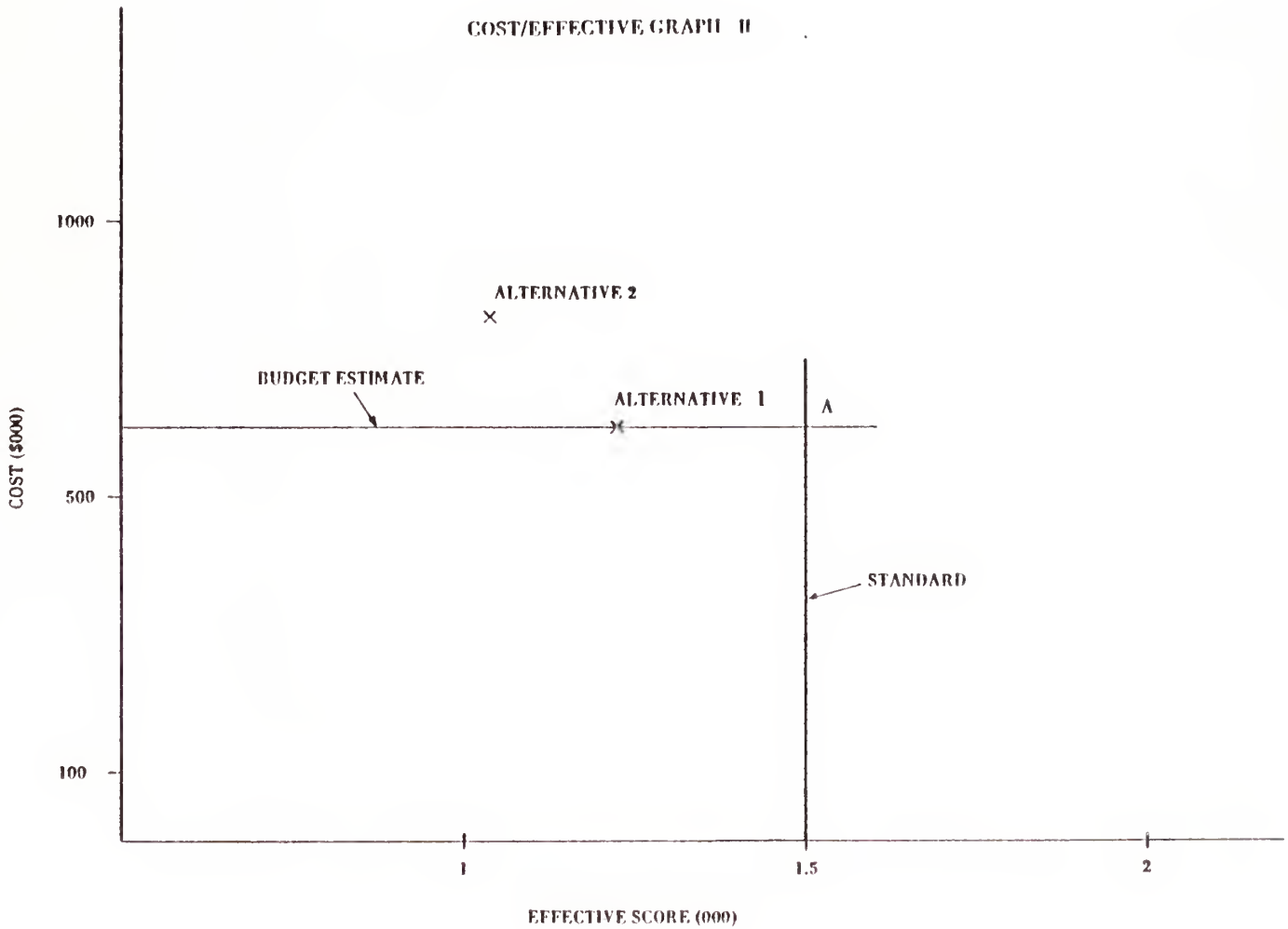
These two figures, 1,230 and 1,040 would be the variables on the effective scale of the graph. The following cost figures are assumed for the above alternatives to demonstrate the following cost effective curve.

Cost of Alternative 1 = 500,000
Cost of Alternative 2 = 750,000
Budget for Transit Service = 600,000

From this example any alternative whose coordinates are closer to point A would be the "best" alternative to implement.

FIGURE 4

COST/EFFECTIVE GRAPH II



If many alternatives were considered, the nearest alternative to point A is the option that meets the budget and objectives of the community. By this procedure an attempt is made to objectively evaluate alternative transit options. When formulating alternatives it is reiterated that modifications to and use of any existing services should be included.

CHAPTER IX

IMPLEMENTATION AND MANAGEMENT OF TRANSIT SERVICE

At this point or stage of the planning process, what should be done to serve the transportation demand that apparently has been found. What is left to be done is to determine how to implement or carry out the "solution".

The factors to be dealt with here are issues concerning the structuring, managing and operating of a transit organization. Discussion on these factors would be centered around, (a) initiation of a new transit service, and (b) expansion of existing service which can be taken over by the local government.

The relations of various organizations delivering transit services and the internal structure of a transit organization as they relate to the above factors will be discussed.

In a comprehensive setup of a transit organization, the following groups and agencies are related to the organization.

1. Human service agency,
2. The elderly,
3. Ethnic minority groups,
4. Business leaders,
5. Political leaders,
6. Taxi and Bus Company leaders, etc.

A full list is shown in the diagram on the next page. These interest groups may vary from area to area such as the case of the study area; inclusion of the Military Post and Kansas State University organization may have to

FIGURE 5

Principal Groups Involved in the Transportation Decision-Making Process

Source: Adapted from Reference [58]

be included. If a broad range of interest groups are included in planning and management of a system, there is a positive response to potential problems such as unfair practices of favoritism or prejudice.

The major question to be discussed here is that the solution or option has been chosen; who should provide the service, public or private agency? Much of the answer depends on the basic analysis and the option chosen. If a new service is to be initiated then the argument continues, however, if the option is, improvement on the existing service, then the answer automatically is given, i.e., who is currently providing the service. Certain improvements might necessitate public action irrespective of who the provider is. Such actions include public takeover or subsidy.

Whatever the decision of the community is, e.g., initiate a new service, change ownership, or significantly improve existing system to provide higher order service, the prime issue is what level of autonomy the transit organization is to have. There are two major sub-components that affect the level of autonomy; they are the legal and financial constraints.

Legal

Regional transit planning is caught within a conglomerate of laws and regulations. The operation of transit systems beyond jurisdictional boundaries are subjected to Commerce Corporation regulations. These regulations have a different impact on type of service, and the financial operations of the service. A review of Kansas laws, and as they effect a subregional concept will be presented briefly below. The degree

of control exercised over a transit organization is influenced by federal and state laws and local ordinances. The Urban Mass Transportation Act, anti-trust laws, unfair competition laws, and tax limitation are all constraints that are put on transit organization.

The concept of a regional transit system pre-supposes three elements, the first being cooperation of local governments in field of planning and development. The planning aspect of such cooperation agreements do not necessitate much legal problems but very few local governments do give regional planning agencies implementation powers. Public operation of transit service on regional basis is fraught with a lot of institutional and legal imperatives.

If a regional transit is to operate in a jurisdictional area of an RPC without implementation powers, then a procedural delegation of power to establish a Regional Transit Authority should be given to the RPC by the cooperating local governments. The question is, would this be legal under the state's statutes? If the answer is "no" then a system-wide service cannot be implemented. Therefore, the option left under the public system is for individual jurisdictional areas to institute separate transit systems. A private system would not be subjected to these institutional constraints, however, how much influence can local citizens exert on such systems? How far would the public be prepared to support private operation with their tax dollars? Would the private agency have enough resource and capabilities to operate under the objectives and standards set forth by the community earlier in the planning process?

These and other questions are hard to answer but it appears the answers depend on what legal constraints exist and what the attitudes of the local citizens are.

The second institutional factor for a public regional transit system to contend with are corporation regulations. This is purely a procedural question and if the application process and requirements are met the possibility of a regional transit operation depends on the Corporation Commission. The main arguments here are: Is there going to be a duplication of services and would some operators be run out of business if a new service is initiated? Hopefully, if the planning process had previously addressed these questions the Corporation Commission's regulations would not be a hindrance in operating a region wide system.

Financial Structure

The ability of a regional transit authority or any transit agency to obtain or provide adequate and continuous funding for a project is of utmost importance. The major sources of funds to a transit organization are; fare box revenues, direct public grants, earmarked tax revenues and public debt. These sources of funds put transit agencies under direct control of the public. It has been argued that public transportation will not be able to pay for itself.[59] The fare structure of private transit systems such as taxis are quite beyond the capability of the poor, elderly, students, and even the average working citizen cannot afford to patronize such services regularly. A public system which can be operated at a lesser

minimum fare would also depend on some subsidy for capital and operating expenses. Funders will often impose strings on the way in which the monies can be used and, if several funding sources are used, several constraints may be placed on the project. This sometimes makes it difficult for private operators who receive these funds to provide all needed services.

Internal Organizational Structure for Transit Management and Operation

Several important functions are carried out by a transit agency and the major functions are described below. These functions are common to most transit organizations. However, some organizations may have more or emphasize different functions than others. Generally this depends on the scale and size of that organization.

Service Function

This refers to actual operation of the service, including those activities that bring the transit service into direct contact with the public. The major functions involve the following:

1. Transit Authority

This agency is usually set up by local governing bodies to offer requisite advice and be the policy making body of public transit operation. This may be a board of five or six members appointed by the local governing body to serve on the authority for some foredetermined time. Usually their duties include the acquisition, construction, ownership, operation and maintenance of public transportation service for the community.

The general powers, duties and organization of such authorities are normally predefined by State Statutes. They offer the forum for citizen participation and are usually composed of transit operators, users and general interest group members. The manager of the transit operation is directly responsible to this board.

2. General Managers

When a decision to implement a transit proposal is reached, the success of the proposal lies in the hands of the chief executive of the operation. He is in charge of the daily responsibility of the operation including all administrative functions of the transit service. Since the success of the operation depends on good management, the selection of a general manager should take into account the perception of individuals on the objectives of the operation.

An enthusiastic and tireless manager, with some imagination, a good public relations personality and ambition, should start the program on a good footing.

3. Drivers

Of all the operational staff members, vehicle drivers are the most crucial link to successful delivery of special transportation services. They are directed by a written schedule or a communication from a dispatcher or passenger. They are responsible for maintaining assigned daily schedules, giving personal aid and assistance to passengers who are disabled, reporting delays in schedule to project offices, and keeping accurate records of passenger travel.

Special qualities are expected out of transit drivers. These include, courteousness, reliability, helpfulness, etc. These qualities are expected by passengers and will help boost ridership. Despite these expectations, drivers are one of the least paid in this enterprise. As a motivation factor, the planner and decision maker should consider better conditions of service for these drivers. Among other things to be considered in this management task are the requirements of state and local agencies summarized in Chapter IV.

4. Dispatchers and Telephone Operators

These people are responsible for assigning buses to their daily schedules, combining requests for service from clients into efficient groups of trips. In transit systems that have the necessary facilities, the dispatcher may also operate the system's radio base station, maintaining frequent contact with drivers. In large systems, telephone operators are engaged who answer calls and transmit orders to the dispatcher. This is an important duty to have responsible people to carry if demand responsive is part of the option.

Other functions with transit services usually engaged by operators are supervisory roles, instructors, etc.

Transit services often engage in minor mechanical functions such as daily servicing of vehicles, routine maintenance and minor repairs. For larger transit operators these shops may be physically separated within the maintenance facility.

The scheduling function can be a full time activity which will involve data collection, analysis and revising routes and schedules for efficient utilization of resources to meet the needs of the community.

Another important function worth mentioning is planning and marketing which can be integrated. There is the need for continuous evaluation and revision of operating strategies in light of changes in conditions and technology. This planning and marketing function may involve:

1. Collection and collation of data, projection of population trends and planning for new areas and service expansion.
2. Coordination with other planning activities in the region.
3. General service improvement in terms of routing, information systems and passenger timetables.
4. Promotion of specific and overall services, etc.

Other roles that should not be left out, especially when the transit service is growing are:

1. fiscal functions,
2. claim functions, and
3. support functions.

The organizational charts on the next two pages are adapted from "Transit Options for Small Urban Communities."[60] For informational purposes it must be pointed out that the role of transit authority is not reflected on the charts.

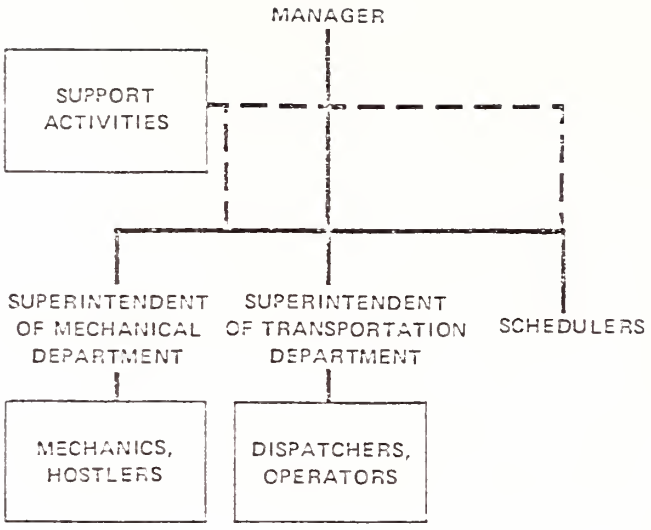


FIGURE 6. BASIC INTERNAL STRUCTURE FOR MEDIUM-SIZED TRANSIT ORGANIZATION

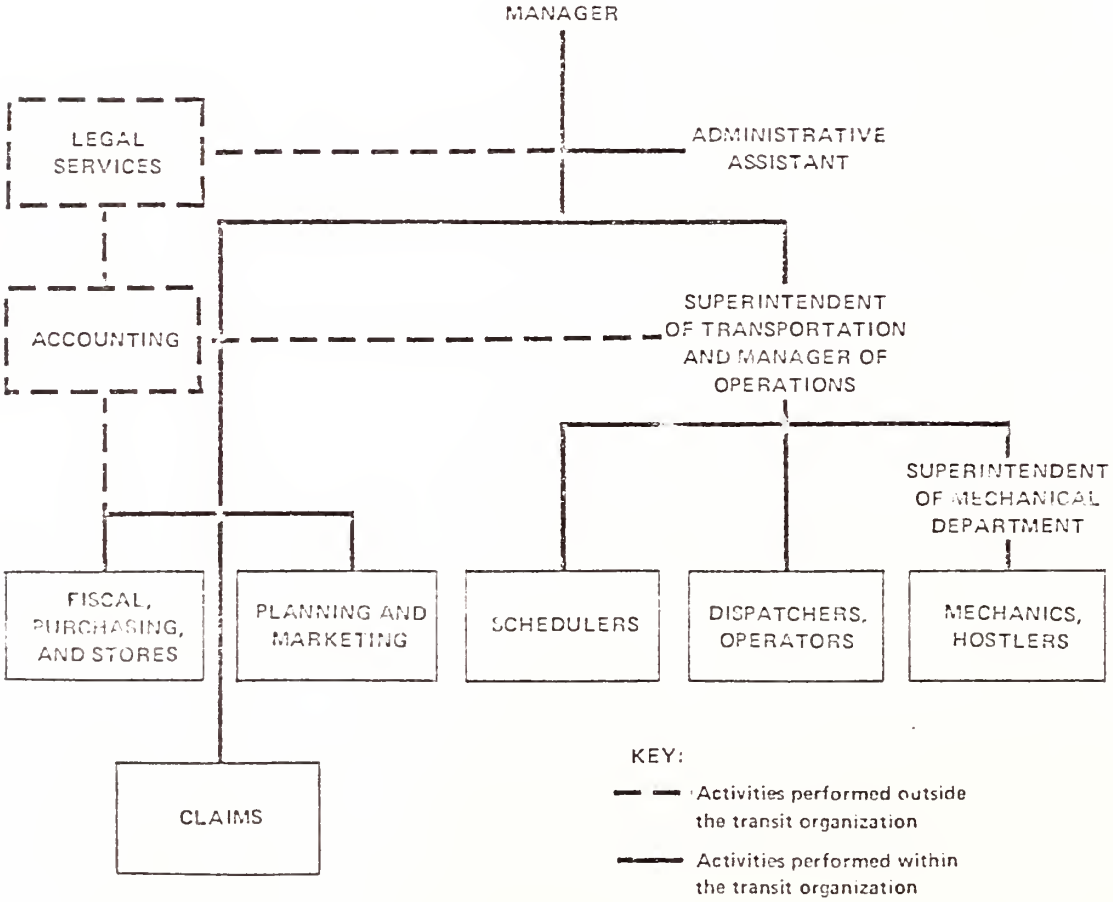


FIGURE 7. VARIATION ON INTERNAL STRUCTURE FOR MEDIUM-SIZED TRANSIT ORGANIZATIONS

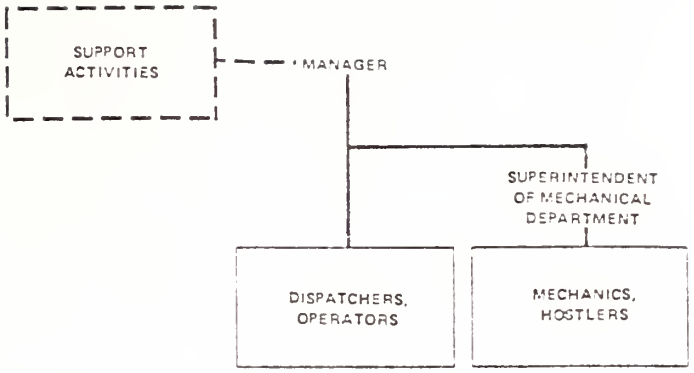


FIGURE 8. BASIC INTERNAL STRUCTURE FOR SMALL TRANSIT ORGANIZATIONS

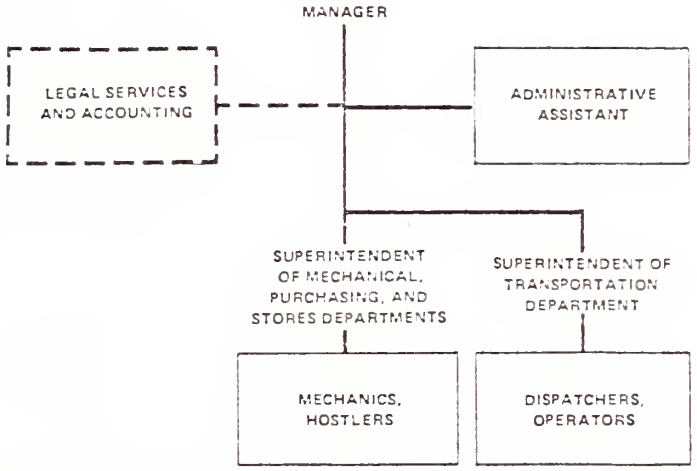


FIGURE 9. FIRST VARIATION ON INTERNAL STRUCTURE FOR SMALL TRANSIT ORGANIZATIONS

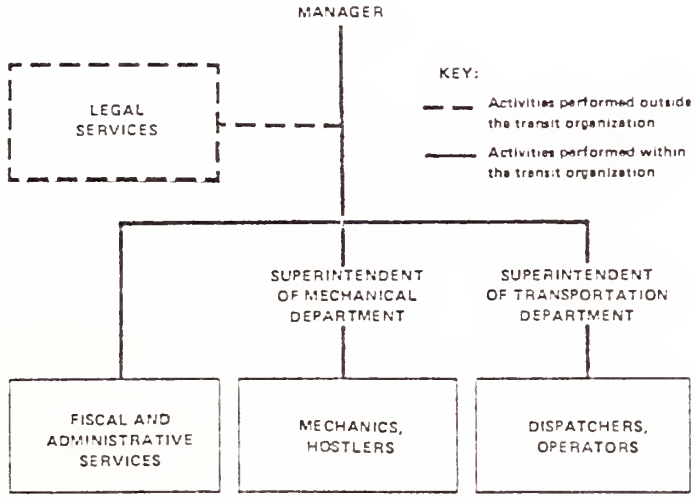


FIGURE 10. SECOND VARIATION ON INTERNAL STRUCTURE FOR SMALL TRANSIT ORGANIZATIONS

Source: Reference 19 is the source for Figures 6 through 10.

External Functions

There are certain functions that would be economically feasible to solicit outside services. These services include legal advice, accounting and high level vehicle servicing.

The financial capability of a transit operation in a non-metropolitan region cannot retain the full-time services of these professionals. In case of a public transit organization such services can be obtained from the City Halls or the County Courthouses.

The Study Area

Riley and Geary Counties form part of the Big Lakes Regional Planning Commission. The question is can the Commission set up a transit authority to oversee an areawide transit system?

It can be argued that a transit authority is not necessary for the successful operation of a transit system. This is partly true, but it is the author's opinion that for successful operation of a coordinated transportation service according to a well conceived plan, some sort of transit authority is necessary. This transit plan is assumed to have a component for both public and private participation. Therefore, the transit authority being advocated is not only responsible to the operation of public transit service, but should provide the forum for exchange of ideas and help preserve the existing private operations which are conceived here as playing a supportive role to a total public transit system. Also a transit authority should have all the powers discussed above, as any other form

of arrangement can starve the transit operation with undue limitations.

The Kansas Statutes in Article 28, 12-2801 through 12-2808 define the general powers, duties and limitations of a Metropolitan Transit Authority. This act refers only to cities of 120,000 people and over, therefore eliminating the study area to institute a transit authority. However, Section 12-717 states:

> "The Metropolitan or regional commission shall make a plan or plans for development of the area... may also assist the cities and counties within its area of jurisdiction in carrying out any regional plan or plans developed by the commission..."

Now the argument is, if provision of a transit plan for the region calls for establishment of a transit authority, would it be legal? The author's opinion is affirmative, for to the best of my knowledge this will not be illegal under any act.

For "MARIGETA" to be a reality, it is advocated that an inter-governmental cooperation agreement be made between the local governments of Manhattan, Riley County, Geary County and Junction City. Kansas State University and Ft. Riley Military Post may be made a part of this letter of agreement to operate a systemwide transit service.

An effective cooperative agreement should cover, (1) defining area of coverage, (2) scope of work, (3) organization structure (including the transit authority formation), (4) the plan itself and provisions thereof, and (5) financing.

The next implementation phase of institutional arrangement is unveiling the plan for the Kansas Corporation Commission since the program will

involve routes presently served by some existing transportation agencies. If a sufficiently good job is done in accordance with the process described above and the existing transit agencies are adequately covered in the plan, and their service domain is clearly defined in the plan, there should be no problems in meeting the requirements of the KCC to obtain their license for the program.[61] Also, one of the criteria KCC might look for is, is this program going to provide any different type of service not presently delivered? From all intents, purposes, and minimal analysis done by this author, the answer to this can be affirmative for there appears to be a need for service to meet the travel needs of students, military and Kansas State University personnel. (See evaluation of existing services as against standards set above, on page 106.)

Funding

The successful implementation of any program obviously depends on continued funding sources. Analysis of the attitudinal survey carried out on a pilot basis indicates that respondents feel that the community should take advantage of federal programs which fund provision of transportation services. Also, respondents feel that agencies like Kansas State University and Ft. Riley Military Post should contribute to the provision of transportation for their clientele. They expect local units of government to also help in funding transportation services.

Funds are needed for planning, capital and operating activities. The Federal government provides some funds for all these areas of

transit service activities, however, it must be reiterated here that there are matching and eligibility requirements. It is expected that in the letters of agreement, apportionment formulas of what each agency or local unit of government should contribute should be clearly stated. If this contribution might require a vote (passing mill levy), the planning process and document can be an informative education document for favorable response by citizens.

Unfortunately the state has no funds for operating or capital transit activity and even an interpretation of Article 9 of the Kansas Constitution prevents state funds for transit improvements (See Appendix G). This and several other issues concerning public transportation is being resolved at the state governmental level. However, this does not prevent local initiative. Hopefully some day funds from the state will relieve citizens in the region.

CHAPTER X

SUMMARY AND CONCLUSION

Summary

The planning approach developed so far started from reviewing current literature to identify a segment of our population that is transportation disadvantaged because of their physical and for socio-economic characteristics, and therefore need some form of public transportation. Also, it was reiterated that the general public, especially those in areas with a concentration of specialized occupations, for example the study area with high college and military population, must be encouraged to use public transportation services.

An areawide approach toward transit development was advocated because of the advantages of economy of scale. In delineating areas for transit planning and development, some technical concepts were presented, but it was advised that political and administrative feasibility should be given serious consideration.

Goals and objectives give direction to planning and since they are supposed to reflect the values and aspirations of the citizens setting them, should be carried out democratically and with the widest possible consensus. An attitudinal survey which measures the concerns of the citizens on specific transportation issues was suggested. Precision and conciseness were thought of as the corollary of objective setting.

A review of varying sources of data was presented and it was postulated that secondary data sources are adequate as far as the source is authentic and has scale and consistency. The U. S. Population Census and local land use plans were preferred as data sources for documenting the socio-economic and land use characteristics of the area.

This model approach laid strong emphasis on coordination of existing services, therefore, it dictates that existing services should be inventoried and evaluated against transit standards which reflect the goals and objectives of the community. Formats and guidelines were presented for these inventory and evaluation exercises. A standard information brief and format were advocated to be used to eliminate biases against some services.

Estimating demand for transportation service was deemed as the core element in transit planning. Six approaches were reviewed as to their relative applicability to non-metropolitan areas at which this model was aimed. An integrated approach using some of the six models was recommended. Basically, the approach was developed as follows:

1. Estimate <u>need</u> of public transportation by some objective criteria such as aggregate estimates discussed above.

2. Carry out a potential ridership survey to help in programming and designing network, by the survey administration approach discussed in Chapter III.

3. Utilize Burkhardt/Lago model to estimate the optimum demand for existing individual services. (If the model indicates that existing services can do better than their

present performance, then there is the need for improvement of general operational characteristics of the services to meet respective capacities.)

4. Sum up the optimum demand estimates of individual existing vehicles and compare with figures arrived at on stage one and two above.

5. If the difference in stage four is substantial to warrant initiation of a new service and/or if existing services cannot be modified to suit the standards set earlier, then a new service is justified.

Various alternatives were considered and reviewed. An integrated system involving different service options was considered as a better approach in meeting the transportation needs of a region because of the differing travel behavior of residents in a community. The cost-effectiveness analysis was recommended as the best approach to evaluate alternative systems to meet the transit demand in a region because it takes the objectives of the community into consideration.

Plan implementation involves financial, legal, operational and organizational elements. These elements should be taken into consideration in each phase of the planning process and should be continuously monitored. An organizational structure which is responsible to a transit authority is recommended. This transit authority should be created by new state statute and should by composed of representatives of transit operators and users, as well as various groups concerned with public transportation.

Conclusion

The author set out to describe an innovative approach toward planning for areawide transit systems, using Riley and Geary Counties to demonstrate how some parts of the model work. The dependence on existing theories in some parts of this planning process may be a source of weakness in the model but its basic strength lies in integrating those theories. This integration makes it possible for the advantages of one theory to compliment the weakness of the other. Also, the use of a sample size (as a pretest) for the study area does not provide a statistically valid basis for drawing conclusions about the study area, but just demonstrates how certain parts of the model is performed. The next step is obviously a complete sampling of the community, as discussed, before analysis and conclusion can be made.

This treatise was not conceived initially as a transit plan for the subregion and should not be interpreted as such. The framework is laid and even in some parts, detailed information was included. It is hoped that the initiative will be taken by the Big Lakes Regional Planning Commission or any other interested agency to carry out the full transit planning process for the subregion. Others who intend to carry out a planning program of public transportation for areas of similar socio-economics that this treatise was intended will find it a useful reference document if not a handbook.

PROCESS BY WHICH REGIONAL PUBLIC TRANSPORTATION PLANS ARE DEVELOPED, COORDINATED AND IMPLEMENTED

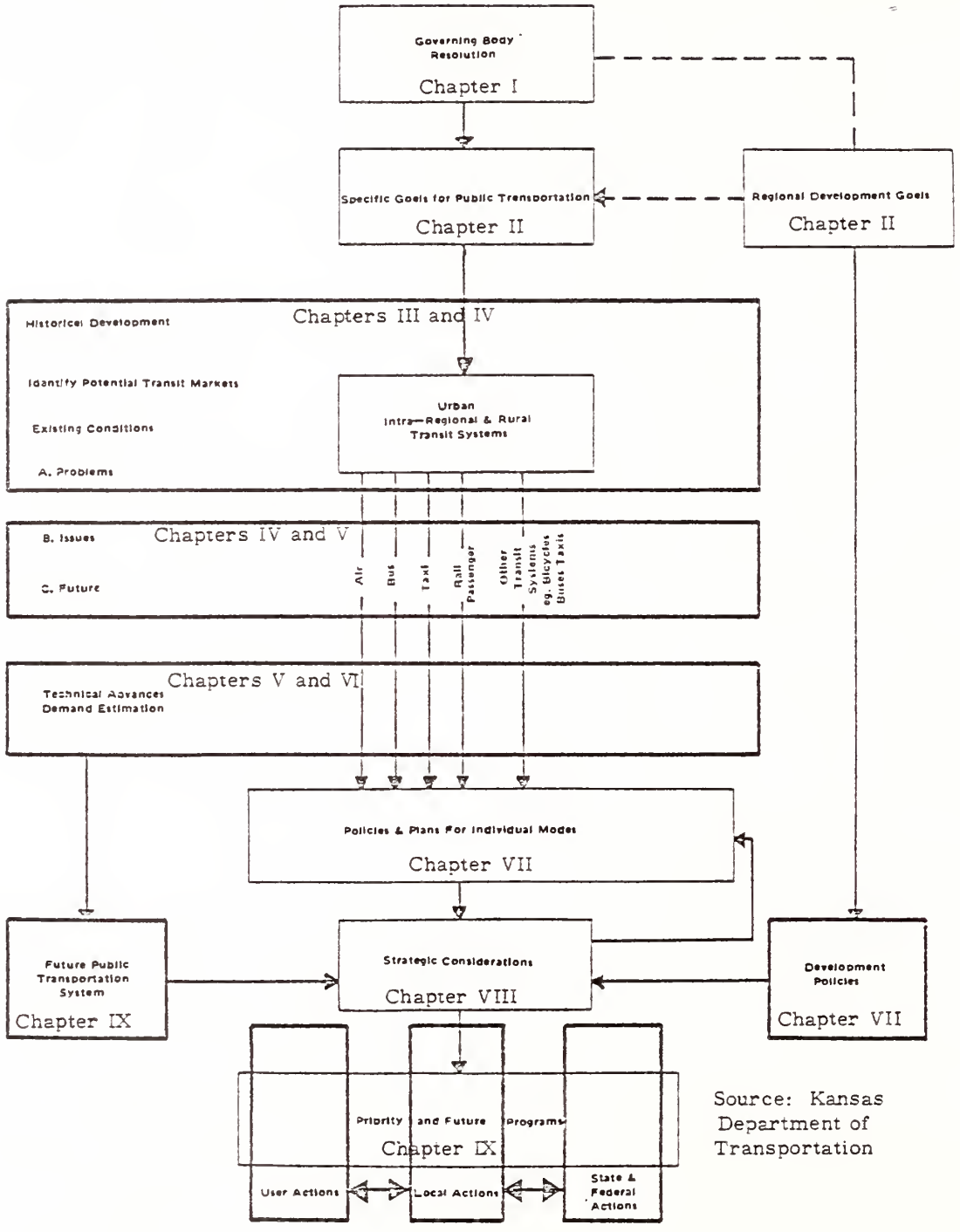


Figure 11. Components in Figure 1 as they relate to the Chapters of the Report.

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40. Bruton, Robert. Rural Transit Operations and Management. Prepared for UMTA, U.S. Department of Transportation. Washington, D.C. 1974. Pg. 15.

41. Burkhardt and Lago, et al. op. cit. Pg. 37-43.

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43. Peat, Marwick, et al. op. cit. Vol. 2, Pg. V60.

44. Burkhardt, Jon E. and Eby, Charles. Need as a Criterion for Transportation Planning. Highway Research Record Number 435. HRB, NRC, Washington, D.C 1973. Pg. 32-41.

45. Miller and Millar. op. cit. Pg. 10.

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47. Allen, William G., Jr., and Dicesare, Frank. Transit Service Evaluation: An Introduction and Preliminary Identification of Variables Characterizing Level of Service. TRB Conference. NRC. Washington, D.C. January, 1976. Pg. 9-23.

48. Iowa Department of Transportation. Manual Guide for Preparing Regional Transit Plan. Transit Division, Iowa DOT, Des Moines, Iowa. November, 1975. Pg. 16.

49. Ibid. Summary of Report.

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52. Office of Service and Methods Demonstration. Small City Transit Amherst, Mass. UMTA, U.S. DOT, Washington, D.C. 1976. Pg.

53. Transit Division (Iowa DOT). Transplan 76. Iowa DOT, Des Moines, Iowa. 1976. Pg. 37.

54. Peat, Marwick, et al. op. cit. Pg. IV.5.

55. Iowa DOT. op. cit. Pg. IX.

56. Peat, Marwick, et al. op. cit. Pg. V.5.

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58. Technology Sharing Program Office. (U.S. DOT) Minibus Profile. Urban Transportation Systems Center. UMTA, U.S. DOT. Cambridge, Mass. 1975.

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60. Peat, Marwick, et al. op. cit. Pg. VI.7.

61. Interview of Jack Sweeney of Kansas Corporation Commission, 11:00 a.m., November 15, 1977 at State Office Building, Topeka, Kansas.

APPENDIX A

STANDARD ERROR FORMULAS

Source: Adapted from Reference 23.

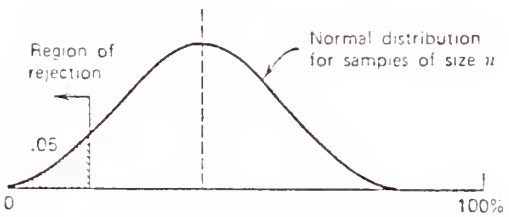
APPENDIX A

Standard Error Formulas

1. State hypothesis that the proportion in question is true: $p^* \geq k$ or $p^* \leq k$. Use the equality $p^* = k$ for the test: where k is some percentage.

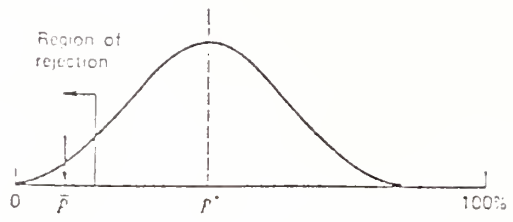
Comment. Our method operates by attempting to reject hypotheses. Therefore, we state the hypothesis as if it were true and attempt to use sample evidence to reject it. In the case of $p^* \geq k$, we set $p^* = k$ and attempt to show that $p^* < k$. In the case of $p^* \leq k$, we set $p^* = k$ and attempt to show that $p^* > k$. If hypothesis is $p^* = k$, then we attempt to show that $p^* \neq k$, for example, that $p^* > k$ or $p^* < k$.

2. State significance level below which hypothesis will be rejected, and collect sample of size n.



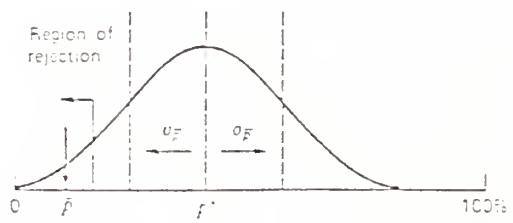
Comment. The significance level serves as the decision criterion for rejecting the hypothesis. Later, we consider another procedure that includes the determination of the sample size.

Calculate sample proportion $\bar{p}$.



4. Calculate standard error of the sample proportion:

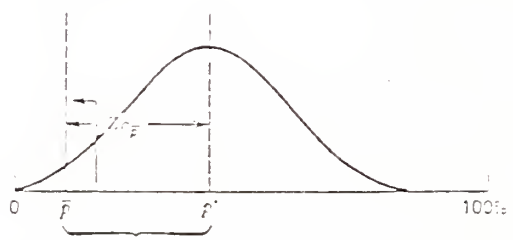
$$\sigma_{\bar{p}} = \sqrt{\frac{p^*(1-p^*)}{n}}$$



If the total population n is not large, multiply by $\sqrt{(N-n)/(N-1)}$

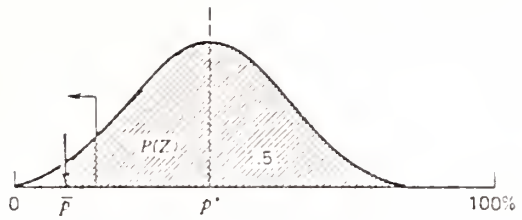
5. Calculate the sample difference and convert into standard error Z:

$$Z = \frac{\bar{p} - p^*}{\sigma_{\bar{p}}}$$

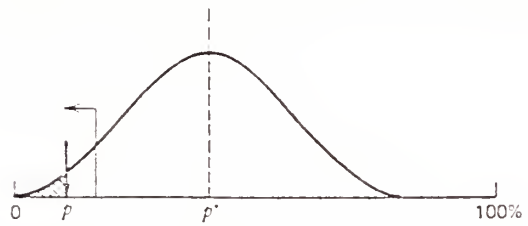


6. Look in the table of the unit normal distribution for the probability that the sample difference $(\bar{p} - p^*)$ is up to Z standard errors below p^* for hypothesis that $p^* \geq k$ (or above p^* for hypothesis that $p^* \leq k$).

$$P(\bar{p} - p^* < Z\sigma_{\bar{p}}) = P(Z) \div .5$$



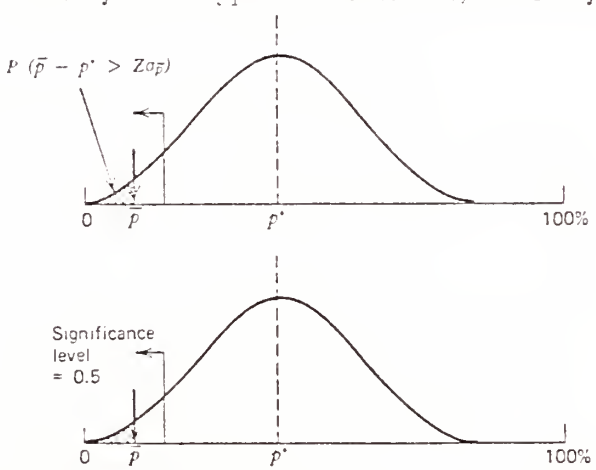
7. Determine the probability that the sample difference $\bar{p} - p^*$ is Z



standard errors below p^* (or above—if hypothesis is $p^* \leq k$):

$$P(\bar{p} - p^* \geq Z\sigma_{\bar{p}}) = 1 - [P(Z) + .5]$$

8. If the probability of this sample difference is less than the significance level, reject the hypothesis. Otherwise, do not reject.



Comment. In our diagram, $P(\bar{p} - p^* > Z\sigma_{\bar{p}})$ is smaller than the significance level. We conclude that the sample difference $(\bar{p} - p^*)$ is too large to have been caused by sampling error. From our decision criterion (the 5% significance level) the sample is accepted as significant, and we reject the hypothesis.

APPENDIX B

COMMUNITY ATTITUDE SURVEY
ANSWERED QUESTIONNAIRE

DATE: 2-[illegible]

CITY: Manhatta

COUNTY: Riley

Appendix B

COMMUNITY ATTITUDE SURVEY

Please check the appropriate column that best describes your position in the community.

X Member of local governing body (elected)

_____ Public official (appointed)

_____ Other (specify) _____

Rate your opinion of the following statements on a scale of 1 to 5. Circle the number which you consider applicable to each particular statement. A score of 1 indicates that you strongly disagree with the statement while a score of 5 means that you strongly agree with the statement.

1. A transit system is needed in your area.

1	2	3	(4)	5
Disagree				Agree

2. Transportation is a problem for the following groups of people in your area.

Elderly

1	2	3	(4)	5
Disagree				Agree

Handicapped

1	2	3	(4)	5
Disagree				Agree

Low-Income

1	2	3	(4)	5
Disagree				Agree

Students

1	2	(3)	4	5
Disagree				Agree

Military Personnel

1	(2)	3	4	5
Disagree				Agree

Staff of Kansas State University

1	(2)	3	4	5
Disagree				Agree

Other Citizens

1	(2)	3	4	5
Disagree				Agree

3. Which agency do you think should provide transportation service to the following groups of people? Please match your answers in Column A with the agency numbers in Column B. If you think 2 or more agencies in Column B should provide services for a particular group of people indicate so.

Column A		Column B
Elderly	2	1. County Government
Handicapped	2	2. City
Low-Income	2	3. Fort Riley Military Base
General Population	2	4. Kansas State University
Students	5	5. Private Nonprofit Organizations
Kansas State University Staff	6	6. None of the Above
Military Personnel	3	

4. Improvements in our area's street parking and highway system are more important than the provision of any sort of public transportation system.

1	2	3	4	5
Disagree				Agree

5. There is a need for increased coordination of existing transportation services.

1	2	3	4	5
Disagree				Agree

6. School buses should be used during non-school hours to provide transportation to other members of the community.

1	2	3	4	5
Disagree				Agree

7. Existing transportation service provides all of the necessary transportation needs of people in this area.

1	2	3	4	5
Disagree				Agree

8. Your area or institution should take advantage of state and federal programs for financing public transportation services.

1	2	3	4	5
Disagree				Agree

9. We should rely on private nonprofit or other service agencies to provide and coordinate all transportation needs of the people and institutions in the area.

1	2	3	4	5
Disagree				Agree

10. If the need for public transportation becomes apparent, support for public transportation would increase.

1	2	3	4	5
Disagree				Agree

APPENDIX C

TRANSPORTATION SERVICE INFORMATION SURVEY

Appendix C

TRANSPORTATION SERVICES INFORMATION SURVEY

A. Agency Name _____

Address _____

_____ Telephone _____

Service Area _____

Name of Contact _____

Title _____

B. Capital Equipment

	Type of Vehicle	Year of Vehicle	Vehicle * (See Equipment Below)					Seating Capacity
			1	2	3	4	5	
1.								
2.								
3.								
4.								
5.								
6.								

* Vehicle Equipment (check)
1. Lift
2. Fold-Down
3. Radio (Dispatching Communication)
4. Securement Devices
5. Other (Specify) _____

6. Who is eligible to ride?

   a. Anybody _____

   b. Those 65 years of age or older _____

   c. Handicapped individuals _____

   d. Those economically disadvantaged _____

   e. Other (Specify) _____

7. What limitations do you have on the service you provide? _____

   _____

8. Drivers:

   Total number _____Total number of volunteers if any _____

   Total number of paid drivers _____

   Qualification Requirements _____

   _____

   _____

9. Other Employees _____

D. Funding Sources

1. a. For vehicle and equipment _____

   b. Operating funds (including funds to cover Administrative expenses)

   _____

2. What is the fare (check with applicable response) _____

   a. No fare _____

   b. Per one-way trip _____

   c. Per mile _____

   d. For subscription service _____

   e. Voluntary contribution _____

   f. Other (Specify) _____

3. Please indicate how much income including fare box, contributions, etc. your service received for the past following years.

1977 _____

1976 _____

1975 _____

1974 _____

5. Would you summarize the unmet transportation need you perceive and any pending service expansion you anticipate? _____

_____

_____

_____

C. System Operations

1. a. Days of Operation _____

   b. Hours of Operation _____

   c. Monthly Miles _____

   d. Number of Monthly Trips _____

   e. Average Daily Passengers _____

   f. Fare Structure _____

2. How long has your service been in operaton? _____

3. How can one receive service?

   a. Call a dispatcher for an appointment. How far in advance must the appointment be made? _____

   b. Be at a designated pick up point in accordance with a published schedule? _____

   c. Other (Specify) _____

4. What kind of service do you operate?

   a. Door to door _____

   b. Door to fixed destination point _____

   c. Fixed route _____

   d. Other (Specify) _____

5. For what purpose do your clients use your service?

   a. Home _____ c. School _____ e. Shopping _____

   b. Work _____ d. Medical Care _____ f. Other (Specify) __

   _____

APPENDIX D

POTENTIAL RIDERSHIP SURVEY

Potential Ridership Survey

Please note that transportation or transit service is used in this survey to mean public transportation such as buses, taxis, carpools, etc. with no particular bias to any one mode.

1. Do you ever use the transportation service available in this area?

   Yes ___ No ___ Service Not Available ___

2. For what purpose or purposes would you consider the use of public transit?

   (a) Home
   (b) Work
   (c) School
   (d) Medical Care
   (e) Shopping
   (f) Social, Recreational Activities
   (g) Civic, Religious Activities
   (h) To go for a Ride
   (i) Other (specify) _____

3. Would you use a transit service if it were provided or an existing service (if any) were improved?

   Yes ___ No ___

4. Rate your perception of the five most needed improvements of existing transit service (if any) in order of importance to you.

   (a) Evening service ___
   (b) Route closer to home ___
   (c) Route closer to destination ___
   (d) Lower fares ___
   (e) More frequent service ___
   (f) Service on Sundays ___
   (g) Shorten time it takes to make a trip ___
   (h) Shorten time it takes to wait for service ___
   (i) New vehicles ___
   (j) Bus benches ___
   (k) Bus shelters ___
   (l) More stops along the routes ___
   (m) Others (specify) _____ ___

5. If you were to ride on a transit vehicle where would you like it to pick you up? (Give address or nearest intersecting streets) _____
   _____

6. How far would you be willing to walk to the nearest transit vehicle pick-up point?

   (a) One block ___
   (b) Two blocks ___
   (c) Three blocks ___
   (d) Other (specify) ___

7. If you were to ride on a transit vehicle where would be the most likely places you will be going and how often? Give name, address or nearest intersecting streets of the place.

   _____

   _____

8. Do you have any problems with getting to the places you normally like to go?

   Yes ___
   No ___ What are the problems? _____
   _____

9. Which three system characteristics in order of importance would be most important to you when deciding whether or not to use the transit service?

   (a) Fare
   How much fare would you be willing to spend per one-way trip? ___
   _____
   (b) Comfortable vehicle ___
   (c) Quick travel time ___
   (d) Courteous driver ___
   (e) Safe driver ___
   (f) Extensive routes (service) ___
   (g) Others (specify) _____ ___

10. Please check your age range

    (a) Under 17 ___
    (b) 17 - 20 ___
    (c) 21 - 39 ___
    (d) 40 - 59 ___
    (e) 60 - 64 ___
    (f) 65 or over ___

11. Please check your yearly income range

    (a) Under $5,000 ___
    (b) $5,000 - $10,000 ___
    (c) $10,000 - $15,000 ___
    (d) $15,000 or over ___

12. Do you have any physical disabilities?

Yes ___ No ___ If yes specify _____

13. What is your occupation or employment?

(a) Staff in Kansas State University ___
(b) Student in Kansas State University ___
(c) Fort Riley Military Personnel ___
(d) Other (specify) _____

APPENDIX E

NOTES ON TRANSIT SERVICE VARIABLES

Source: Adapted from Reference 47

Second, the variables must be disaggregated by areas of the metropolitan region. That is, in monitoring service variables, reference must be made to a specific part of the city. The extent of this geographical breakdown depends on the particular circumstances of the evaluation, but at least should include distinctions between transit service in the central city and suburban areas.

QUANTITY

User

Routes:

Transit quantity is composed of three things: the transit routes, the number of buses that run on those routes, and the number of seats contained in those buses.

Route density is an indicator of route quantity relative to city size. It is expressed either in miles of round trip bus routes (referred to as "route-miles") per square mile of service area or in terms of vehicle-miles per square mile divided by population in the service area.

Route distribution, like route density, accounts for the physical layout of routes. It is measured in vehicle-miles per capita (again using the population of the service area as a base).

Route coverage is tabulated in two ways. Coverage is defined as the proportion of service area and population, respectively, that lie within one quarter mile of all transit routes.

Vehicle use is the average daily number of hours and miles operated per bus. This variable helps to determine the efficiency of vehicle utilization.

Frequency:

Frequency of service is considered one of the primary facets of transit level of service. There are some indications that frequency is more important than fares influencing ridership (7).

Headway, or the time between buses in minutes, is the primary measure of schedule frequency.

Capacity:

Vehicle seat capacity is a gross measurement of the overall transit capacity relative to community size, measured as population in the service area divided by total seating capacity.

Route capacity refers to the maximum practical movement of people in one direction along any one link of the transit system. It is primarily a function of route structure and frequency.

Non-User

Route Congestion:

Transit route congestion is the condition of too many buses occupying a section of street at once, thereby crowding out the automobiles. This does not include street lanes that have been reserved for the exclusive use of buses, but perhaps this statistic (buses per hour) could be used as a warrant for such lanes.

QUALITY

User

Speed:

Scheduled speed in miles per hour is determined from bus schedules and street maps. Again, average system speed is the primary indicator. Factors that influence speed include route length, turning movements, number and spacing

of stops, and traffic conditions (3). Speed, in turn, vitally affects fleet size, fuel consumption, operating costs (especially labor), passenger attraction, and overall urban mobility (6), 2).

Ratio of transit to auto speed: since transit and auto speeds are highly correlated in some cases, this ratio denotes a level of service for drivers as well as transit riders.

Reliability:

On-time performance is defined as the percentage of scheduled buses that are on time (1 min. early to 4 min. late). Definitions of "on-time" vary somewhat, but the figures cited here are representative, and are substantiated in reference 4.

Comfort:

While perhaps not as important as headway or fare, the comfort of a transit ride is nonetheless considered to be a nontrivial component of level of service (6, 11, 12).

Noise levels to which the driver and passengers are subjected can easily be measured with a sound level meter in terms of "A" - weighted decibels (dB(A)) at various points inside the bus. However, due to the subjective nature of this variable and the incomplete knowledge of the effects of noise on people, a standard might be difficult to define.

Loading factors are defined as the allowable maximum number of passengers/ total seats available per 30 minute period taken at the point of maximum loading (9).

Floor area per passenger is simply another way of looking at a situation of overcrowded buses but is more specific in that it takes into account the space requirements for standing and seated passengers.

Interior vehicle lighting in footcandles would measure average illumination for buses used in night or early morning service. No criteria for this was discovered in the reference, but standards of illumination for various tasks such as reading can be found in architectural literature.

Vehicle jerk, or time rate of change of acceleration measured in miles per hour per second per second (mph/s^2). This describes how much the bus lurches forward as it first moves from a standing position and is a function of the vehicle performance and the driver's abilities.

Convenience:

Convenience inlcudes some items that pertain to comfort, but is primarily directed toward the ease with which one may use the transit system.

Route directness is the percentage of trips that require a transfer. A high proportion of transfers may be indicative of a poorly-planned route network, although factors such as topography and urban form have a significant effect but are beyond transit management's control.

Hours of service denotes the total hours that transit service is available on weekdays and weekends.

Average curb-to-vehicle step height is measured in inches. Even though curbing is outside the transit agency's control, and step clearances are regulated by the bus manufacturer, level of service is increased if the operator takes action to remove or diminish this barrier.

Stop spacing, the distance in feet between successive bus stops along a route, is a measure of transit accessibility. Reduced stop spacing decreases walking distance to the stop but increases the number of stops, thereby decreasing running speed. The operator should seek an optimal balance between stop spacing and speed.

Loading zone quality includes such variables as curb length reserved for buses, bus stop marking, exterior illumination of the loading area, and the availability of benches, bus shelters, or natural shelter. These affect level of service in a somewhat subjective manner, although standards exist for curb length (7) and warrants have been developed for the necessary incidence of passenger movements prior to erecting benches and shelters (23).

Information services, a list of subjectively described attributes, encompass schedule availability and coherence, route identification (bus stop signs and destination signs on the buses), telephone information service, and marketing and promotional activities. Transit service is much more valuable to the community if potential users are actively made aware of the routes and schedules (13). Studies have shown that when faced with schedules that appear to be complex, many people do not use them (24).

Safety and Security:

Accidents and crimes: Accidents involving buses reduce schedule reliability, which can lead to a decrease in ridership. Crime on buses or at bus stops tends to scare passengers away from transit, inflicting large indirect economic and social "costs" (25). These statistics are usually tabulated as accidents or crimes per million vehicle-miles or in direct costs of accidents or crimes.

Special Services and Innovation:

This category was created by the authors to account for those aspects of transit service that can be of definite benefit to the community but do not belong in any other grouping.

Special services and innovation includes such physical attributes as computerized bus scheduling, two-way radio link between driver and dispatcher, and prefential treatment and traffic control measures (e.g., bus-actuated traffic

lights). It also involves didfferent types of service, like demand responsive transit, express/park-and-ride routes, downtown (or shoppers') shuttle, bus service for special community events, or school service.

Non-User

The principle interests of the non-user are in transit efficiency and ridership, or demand. These help indicate how well transit is fulfilling the role of facilitating urban mobility.

System Efficiency:

Equipment utilization explains how many of the buses on hand are being used in revenue service, expressed as scheduled vehicle-hours/available vehicle-hours. Obviously all the buses cannot be operated all the time, but the operator is obliged to the public to use his equipment as efficiently as possible.

Peaking factor is the ratio of scheduled peak (usually the AM peak) vehicles to scheduled base vehicles. The operator has not control over the AM and PM peaks of travel, but possibilities may exist for more extensive transit service between the peaks, smoothing them out, in effect.

Energy efficiency is passenger-miles per gallon of fuel. Proper maintenance and high speeds are the primary contributors to miles per gallon but the potential for high energy efficiency depends most on passenger-miles per gallon. The possible energy savings due to transit should not be overestimated, however, since there is a sizeable difference in what could theoretically occur and what probably will happen.

Air and noise pollution: The diesel engine that propels most buses is inherently cleaner than a similar spark ignition engine of the kind generally found in U. S. automobiles (26), but as standards are developed for limiting automotive emissions, buses should be included also. Engine emissions, as

as gaseous compounds are concerned, are measured in grams of pollutant per brake horsepower-hour. The major problems associated with bus pollution, though, are smoke (measured in terms of the Ringelmann number) and odor (which at present has no satisfactory method of measurement) (27). Likewise the matter of noise is receiving more study as New York State and California have enacted limits on the dB(A) that automobiles may emit under certain circumstances (28). Pollution abatement in general is important in the overall level of service offered to the community.

Manpower productivity measures the efficient utilization of personnel. This takes the form of two statistics: platform hours/pay hours and annual passengers per employee. The former measures the amount of time that the driver is actually engaged in picking up passengers (platform hours) compared to the time for which he is being paid (pay hours). This will generally be less than 1.0 but the closer to that figure, the better. Annual passengers/employee is a commonly used method of gauging ridership in terms of the size of the system.

Demand:

The relationship between level of service and transit demand is analogous to the proverbial chiden-and-egg problem in some respects. Increased levels of service and increased patronage can each be viewed as a result of the other.

Modal split (for work trips, since this is the most important): This is defined as the percentage of all daily work trips that use transit, and varies fairly predictably with the size of the urban area.

Service usage is annual total passengers/service area population. In other words, the average annual number of transit rides per capita.

Passenger density is described in terms of annual total passengers per square mile of service area. This is a measure of the sparseness of ridership. Density of usage denotes ridership along a route in a one-dimensional sense. Measured in passenger-miles per route-mile it gives perhaps a better idea of system use relative to service quality than the two preceding characteristics. Vehicle occupancy, another similar indicator, is the average number of passengers per vehicle per hour.

Seat turnover, or total passengers per seat-mile, describes to what extent bus seats are being used on the average and directly affects loading factors and optimum bus size.

Desire coincidence is the degree to which passengers' origins and destinations are connected by transit routes. It is measured subjectively by comparing maps of established (and/or predicted) origin-destination patterns (which should be available from the regional planners) with maps of the total transit network. If these maps coincide substantially, then good bus routing is indicated.

COST/REVENUE

User

Fare:

Base fare should be considered in several ways. Among these is the relative cost to the user of automobile and bus transportation, that is, auto user cost per mile/bus user cost per mile. Probably the ultimate test of a fare structure is that it should not be socially counterproductive in terms of the agreed upon goals of the community (29).

Transfer fares, zone fares, and reduced fares for the handicapped and elderly can be viewed together as elements of the fare structure that affect level of service.

Methods of fare collection affect both the rider and operator. Such methods certainly influence the ease with which transit may be used. Furthermore, the operator must strike a delicate balance between acceptance by passengers and drivers, efficiency in fare accounting and records keeping, and the cost of various methods in selecting fare collection techniques.

Non-User

Operating Economy:

Operating ratio of total operating costs/total revenues.

Route economy is defined as operating cost and revenue per vehicle-mile, and is one of the most useful measures of transit economy that the operator and community have.

Average fare, the average revenue per passenger, can be computed in two ways. In practice, it is passenger revenue/total passengers or can be determined empirically from knowledge of the fare structure and passenger categories. Operating cost per passenger is also a widely used indicator. Combining these two yields the net deficit per passenger, which is the explicit cost of the average transit ride to those who are subsidizing transit service (excluding other sources of revenue).

Total cost of bus maintenance per vehicle-mile affects many other features of level of service. Among these are vehicle and manpower efficiency, energy efficiency, air and noise pollution, and operating ratio. Extensive maintenance facilities and equipment represent a considerable capital investment which may be justified on the basis of increased level of service.

Factors Outside the Control of the Transit Agency

A consideration that should be inherent in this listing of characteristics is the fact that some of them may be partially or totally out of the control of the regional transportation authority or planning commission.

APPENDIX F

STATE OF KANSAS SPECIFICATIONS FOR TRANSIT BUSES

Source: Kansas Department of Transportation
Planning and Development Department

State of Kansas Specifications for Transit Bus (22-26-Passenger)

The following specifications shall apply to the purchase of small transit bus type vehicles by the State of Kansas. The State reserves the right to waive minor technicalities under this specification.

The small transit buses must comply with the Federal and Kansas laws and Kansas Corporation Commission regulations applicable to passenger vehicles of this type.

The bidder agrees, if his proposal is accepted, to guarantee the design, material and workmanship of the vehicle bid according to the standard factory warranty, a copy of which must be furnished with the bid and shall furnish a properly executed service and warranty policy with each unit.

ESTIMATED QUANTITY TO BE PURCHASED: 22-26-passenger: 1

ENGINE: Shall be 350 (minimum) cubic inch heavy duty V-8 including oil filter, air cleaner, and heavy duty radiator, capable of providing sufficient cooling capacity for the operation of air conditioning equipment necessary to meet these specifications contained in the air conditioning option. The expanded cooling capacity shall be provided whether or not the air conditioning option is ordered.

TRANSMISSION: Five-speed heavy duty sycromesh or four-speed heavy duty automatic.

BRAKES: Shall be hydraulic, equipped with a dual hydraulic system. Front brakes may be either drum or disc type. Rear brakes to be drum type. The surface area of the brakes shall be sufficient to meet Federal and Kansas Corporation Commission braking standards for the vehicle class.

G.V.W.: Shall be of 13,500 pounds (minimum).

AXLES: Front axle to be of 4,500 pounds (minimum) and capable of supporting the design share of the G.V.W. Rear axle to be of 11,000 pounds (minimum) and capable of supporting its design share of the G.V.W. Rear axle to be full floating.

SPRINGS: Heavy duty springs shall be furnished at each wheel location of sufficient rating to support the design share of the G.V.W.

SHOCK ABSORBERS: Heavy duty shock absorbers shall be located at each wheel position and shall be properly rated for the vehicle.

INTERIOR FLOOR TO CEILING HEIGHT: 72 inches (minimum) at the aisle.

WHEELS: Shall be 19.5" x 6" (minimum). Seven (7) to be furnished including dual wheels at the rear axle and spare wheel.

TIRES: 8.00" x 19.5", 8-ply rating all weather tread.

FUEL TANK: 36-gallon (minimum).

STEERING: To be equipped with power steering.

ALTERNATOR: 105 Amp. (minimum) heavy duty.

BATTERY: 12-Volt, 105 Amp. (minimum).

BODY: The body shall be integrally mounted to the chassis and conform structurally to Federal Motor Vehicle Safety Standards. The passenger section windows shall be split sash, school bus type windows, or their equivalent. All doors shall be fitted with windows to provide maximum visibility to the driver. All windows shall be tinted safety glass. The initial entry step at the passenger door shall not exceed 14 inches. The walls and ceiling of the vehicle shall be insulated with fiberglass blankets securely attached to prevent shifting of the material during vehicle operation.

DRIVE SHAFT: Must be properly supported, balanced and guaranteed not to vibrate. It must also be protected by a metal guard or guards.

INSTRUMENTS: The following instruments shall be located in the dash in clear view of the driver: amp. indicator, engine temperature gauge, oil pressure gauge, fuel gauge, and the instrument panel shall be properly illuminated for night time viewing.

ACCESSORIES: To be equipped with self-cancelling turn indicators, flashing light signals front (in parking lights) and rear (in dual tail lights), dual two-speed electric windshield wipers, windshield washers, dual sun shades, horn, right and left outside rear view mirror to be Junior West Coast (mirror head not less than 6" x 9"), tire tools, suitable jack and all other regularly furnished tools and equipment to be conveniently stored inside the vehicle. The passenger door shall be equipped with a suitable driver control mechanism. A clipboard holder shall be provided within reach of the driver's seat.

FLOOR: The seating area of the vehicle shall be covered with a 5/8" (minimum) thick exterior grade plywood securely attached to the vehicle floor. Floor covering of fire retardant rubber shall be glued to the plywood floor, it shall be smooth throughout except ribbed at the center aisle. All exposed edges shall be protected with metal edge trim.

LIGHTS: Adequate lighting (dome lights) shall be located inside the vehicle to provide for passenger and driver convenience and safety. All lighting controls shall be located within easy reach of the operator's seat. Exterior lighting shall conform to Kansas Statutes covering vehicle lighting (KSA 8-1703 to 8-1723).

SEATING: The vehicle shall be equipped with a minimum of 24 forward facing seats in addition to the operator's seat. Each seat shall provide a minimum of 18 inches of rump room. Seating rows will be spaced at a minimum of 28½ inch centers. The driver's seat shall be a deluxe bucket type seat with heavy duty vinyl covering. The passenger seats shall be fully padded and covered with heavy duty vinyl. All material used in the upholstery of the seats shall be of fire retardant material.

LEGAL EQUIPMENT: Six pound dry chemical fire extinguisher, ICC vehicle warning device, two first-aid units to meet State Specifications.

WINDSHIELD: To be tinted and conform with Kansas and Federal safety requirements.

HEATER AND DRFROSTER: Heating equipment shall conform to the following:

(1) An inside temperature of not less than 50 degrees Fahrenheit at average minimum January temperatures as established by the U. S. Department of Commerce, Weather Bureau, for the area in which the vehicle is to be operated shall be maintained throughout the bus.

(2) All heaters shall bear a name plate which shall indicate the heater rating in accordance with the standard code for testing and rating automotive bus hot water heating and ventilating equipment, said plate to be affixed by the heater manufacturer which shall constitute certification that the heater performance is as shown on the plate.

(3) Heater hoses shall be adequately supported to guard against excessive wear due to vibration. The hoses shall not dangle or rub against the chassis or sharp edges and shall not interfere with or restrict the operation of any engine function. Heater hose shall conform to standard SAE J20c. Heater lines inside the passenger compartment shall be guarded to prevent accidental contact by driver or passengers.

Defrosting equipment shall keep the windshield, the window to the left of the operator and the glass in the service door clear of fog, frost, and snow. Defroster ducts, if used, shall be designed to prevent the placing of objects which might obstruct the flow of air. Portable heaters may not be used.

PAINT: Solid color with possible stripe, bumpers and wheels to be painted black. Colors to be specified on order.

PADDED STANCHIONS AND GRAB RAILS: All stanchions and grab rails shall be of one inch (minimum) diameter metal tubing and covered with impact absorbing material at least 3/8 of an inch thick.

Full length ceiling grab rails are required on each side of the aisle.

A stanchion shall be located to the rear of the driver's seat at the edge of the aisle and a grab rail shall extend from the stanchion to the side wall of the vehicle behind the driver's seat.

A stanchion shall be located to the left of the entrance door at the corner of the step well, a grab rail shall extend from the stanchion to the wall of the vehicle at the left of the step well. A metal modesty panel shall be provided at this location.

A grab rail shall be attached to the modesty panel parallel to the step line on the left of the entrance. An appropriate hand hold or grab rail shall be provided to the right of the entrance.

DELIVERY: The transit bus shall be delivered F.O.B. the destination shown on the purchase order fully equipped in accordance with the specifications and proposal.

The transit bus is to be properly serviced, including grease and oil to the proper level. Properly serviced shall mean the doors shall have been checked and properly adjusted, fittings all accounted for and all other mechanical

adjustments made and in the condition in which the transit bus would be offered to any section of the trade.

Factory predelivery service or any other delivery service is acceptable only when equivalent to that offered by the dealer to his regular retail customers. After the transit bus has been serviced, the dealer may make delivery by driving or truck transport delivery. Truck transport delivery is acceptable only when the dealer or his authorized representative is present to sign receipts, supervise unloading and deliver the transit bus complete with bill of sale and warranty to the proper State employee at the address shown on the purchase order. Delivery by any method is not acceptable unless the transit bus is accompanied by the bill of sale.

At time of delivery the gasoline tank must be at least one-fourth (¼) full as indicated on the gauge. All vehicles shall be delivered with adequate radiator protection, to at least 20 degrees below zero, by a good grade of Ethylene Glycol Anti-Freeze.

All deliveries shall be made between the hours of 9:00 a.m. to 12:00 Noon or 1:00 p.m. to 4:00 p.m. Monday through Friday holidays excepted.

WARRANTY: The Standard Factory Warranty shall apply to all transit buses. A properly executed warranty MUST be delivered with each transit bus. All service called for in the Standard Warranty shall apply without exception. An owner's care book shall also be included with each vehicle.

Supplemental Specifications
for
Small Transit Bus
(22-26-Passenger)

OPTION ITEMS:

AIR CONDITIONING: Air conditioning equipment shall be installed capable of providing adequate cooling and dehumidifying capacity for passenger comfort. The delivery system shall provide a reasonably constant temperature throughout the vehicle. The system shall be capable of maintaining a temperature of 75 degrees Fahrenheit (F) and 50 percent humidity inside the vehicle, at 90 degrees F outside temperatures and extremely high humidity conditions.

The bidder shall provide complete details on the compressor, condenser and evaporator units and shall state exactly the power required to operate the condenser fans whether electrical or mechanical.

The air conditioning equipment shall be installed in a manner that will not affect the seating capacity of the vehicle. All controls will be located to allow convenient access from the operator's seat. All wiring, tubing and fitting shall be encased to provide maximum protection against accidental damage.

SCHOOL BUS OPTION: This option contains two bid items.

Option 1: Chassis and Body Modification: This item shall include all modifications required to bring the base vehicle into compliance with Federal and Kansas school bus requirements with the exception of the items specified in Option 2 below. Please list the modifications to be provided.

Option 2: Paint, Lettering and Lighting: This item includes any additional cost for paint and lettering required of school buses, additional lighting and stop arm installation to bring the vehicle into full compliance.

Note: Option 1 may be specified individually, however, Option 2 will only be specified as an addition to Option 1.

FORM OF BID

SMALL TRANSIT BUS
22-26-Passenger

ESTIMATED QUANTITY		
1	Small Transit Bus 22-26-Passenger	$_____/ea.

OPTIONS:

1 Air Conditioning _____

School Bus Option

1 Option 1: Chassis and Body Modification _____

1 Option 2: Paint, Lettering and Lighting _____

The above must meet the attached Specifications Titled Small Transit Bus (22-26-Passenger)

Specify Make and Model of the Vehicle Offered:

_____

Specify approximate delivery date _____.

State of Kansas
Specifications
for
Small Transit Buses
(16-21-Passenger)

The following specifications shall apply to the purchase of small transit bus type vehicles by the State of Kansas. The State reserves the right to waive minor technicalities under this specification.

The small transit buses must comply with all Federal and Kansas laws and Kansas Corporation Commission regulations applicable to passenger vehicles of this type.

The bidder agrees, if his proposal is accepted, to guarantee the design, material, and workmanship of the vehicle bid according to the standard factory warranty, a copy of which must be furnished with the bid and shall furnish a properly executed service and warranty policy with each unit.

ESTIMATED QUANTITY TO BE PURCHASED: 16-21-passenger: 1

ENGINE: Shall be 350 (minimum) cubic inch heavy duty V-8 including oil filter, air cleaner and heavy duty radiator, capable of providing sufficient cooling capacity for the operation of the air conditioning equipment necessary to meet these specifications contained in the air conditioning option. The expanded cooling capacity shall be provided whether or not the air conditioning option is ordered.

TRANSMISSION: Shall be four-speed heavy duty sycromesh or Heavy duty three-speed automatic.

BRAKES: To be front power disc and rear drum type with a dual hydraulic system. The total braking system shall be adequate to meet federal and Kansas Corporation Commission braking standards for the vehicle class.

G.V.W.: Shall be 8800 pounds (minimum).

FRONT AND REAR AXLES: Front axle shall be heavy duty not less than 3500 pounds capacity. The rear axle shall be limited slip not less than 6000 pounds capacity, gear ratio to be between 3.5:1 and 4.1:1. Rear axle to be equipped with dual wheels.

WHEEL BASE: To be 125 inches (minimum).

SPRINGS: Front springs to be heavy duty with a capacity of 1750 pounds (minimum). Rear springs to be heavy duty with a 3000 pound (minimum) capacity.

SHOCK ABSORBERS: Heavy duty front and rear.

OVERALL VEHICLE LENGTH: 210 inches (minimum).

INTERIOR FLOOR TO CEILING HEIGHT: 62 inches (minimum) at the aisle.

WHEELS: To be a minimum 16.5" x 6". Seven (7) to be furnished including dual wheels at the rear axle and spare wheel.

TIRES: 8.00" x 16.5" load range D or the equivalent. Seven (7) tires to be appropriately mounted and inflated.

FUEL TANK: 36 gallon (minimum).

STEERING: To be equipped with power steering.

BATTERY: 12-Volt, 105 Amp. (minimum)

ALTERNATOR: 90 Amp. (minimum) heavy duty

BODY: The body shall be integrally mounted to the chassis and conform structurally to Federal Motor Vehicle Safety Standards. The passenger section windows shall be split sash, school bus type windows, or their equivalent. All doors shall be fitted with windows to provide maximum visibility to the driver. All windows shall be tinted safety glass. The initial entry step at the passenger door shall not exceed 14 inches. The walls and ceiling of the vehicle shall be insulated with fiberglass blankets securely attached to prevent shifting of the material during vehicle operation.

DRIVE SHAFT: Must be properly supported, balanced and guaranteed not to vibrate. It must also be protected by a metal guard or guards.

INSTRUMENTS: The following instruments shall be located in the dash in clear view of the driver: amp. indicator, engine temperature gauge, oil pressure gauge, fuel gauge and the instrumented panel shall be properly illuminated for night time viewing.

ACCESSORIES: To be equipped with self cancelling turn indicators, flashing light signals front (in parking lights) and rear (in dual tail lights), dual two-speed electric windshield wipers, windshield washers, dual sun shades, horn, right and left outside rear view mirrors to be Junior West Coast (mirror head not less than 6" x 9"), tire tools, suitable jack and all other regularly furnished tools and equipment to be conveniently stored inside the vehicle. The passenger door shall be equipped with a suitable driver control mechanism. A clipboard holder shall be provided within reach of the driver's seat.

FLOOR: The seating area of the vehicle shall be covered with a minimum 5/8" thick exterior grade plywood securely attached to the vehicle floor. Floor covering of fire retardant rubber shall be glued to the plywood floor, it shall be smooth throughout except ribbed at the center aisle. All exposed edges shall be protected with metal edge trim.

LIGHTS: Adequate lighting (dome lights) shall be located inside the vehicle to provide for passenger and driver convenience and safety. All lighting controls shall be located within easy reach of the operator's seat. Exterior lighting shall conform to Kansas Statutes covering vehicle lighting (KSA 8-1703 to 8-1723).

SEATING: The vehicle shall be equipped with a minimum of 16 forward facing seats in addition to the operator's seat. Each seat shall provide a minimum of 18" of rump room. Seating rows will be spaced at a minimum of 28½ inch centers. The driver's seat shall be a deluxe bucket type seat with heavy duty vinyl covering. The passenger seats shall be fully padded and covered with heavy duty vinyl. All material used in the upholstery of the seats shall be of fire retardant material.

LEGAL EQUIPMENT: 6-pound dry chemical fire extinguisher, ICC vehicle warning device, two first-aid units to meet State Specifications.

WINDSHIELD: To be tinted and conform with Kansas and Federal safety requirements.

HEATER AND DEFROSTER: Heating equipment shall conform to the following:
(1) An inside temperature of not less than 50 degrees Fahrenheit at average minimum January temperatures as established by the U.S. Department of Commerce, Weather Bureau, for the area in which the vehicle is to be operated shall be maintained throughout the bus.

(2) All heaters shall bear a name plate which shall indicate the heater rating in accordance with the standard code for testing and rating automotive bus hot water heating and ventilating equipment, said plate to be affixed by the heater manufacturer which shall constitute certification that the heater performance is as shown on the plate.

(3) Heater hoses shall be adequately supported to guard against excessive wear due to vibration. The hoses shall not dangle or rub against the chassis or sharp edges and shall not interfere with or restrict the operation of any engine function. Heater hose shall conform to standard SAE J20c. Heater lines inside the passenger compartment shall be guarded to prevent accidental contact by driver or passengers.

Defrosting equipment shall keep the windshield, the window to the left of the operator and the glass in the service door clear of fog, frost and snow. Defroster ducts if used shall be designed to prevent the placing of objects which might obstruct the flow of air. Portable heaters may not be used.

PAINT: Solid color with possible stripe, bumpers and wheels to be painted black. Colors to be specified on order.

PADDED STANCHIONS AND GRAB RAILS: All stanchions and grab rails shall be of one inch (minimum) diameter metal tubing and covered with impact absorbing material at least 3/8 of an inch thick.

Full length ceiling grab rails are required on each side of the aisle.

A stanchion shall be located to the rear of the driver's seat at the edge of the aisle and a grab rail shall extend from the stanchion to the side wall of the vehicle behind the driver's seat.

A stanchion shall be located to the left of the entrance door at the corner of the step well, a grab rail shall extend from the stanchion to the wall of the vehicle at the left of the step well. A metal modesty panel shall be provided at this location.

A grab rail shall be attached to the modesty panel parallel to the step line on the left of the entrance. An appropriate hand hold or grab rail shall be provided to the right of the entrance.

DELIVERY: The transit bus shall be delivered F.O.B. the destination shown on the purchase order, fully equipped in accordance with the specifications and proposal.

The transit bus is to properly serviced, including grease and oil to the proper level. Properly serviced shall mean the doors shall have been checked and properly adjusted, fittings all accounted for and all other mechanical adjustments made and in the condition in which the transit bus would be offered to any section of the trade.

Factory predelivery service or any other delivery service is acceptable only when equivalent to that offered by the dealer to his regular retail customers. After the transit bus has been serviced, the dealer may make delivery by driving or truck transport delivery. Truck transport delivery is acceptable only when the dealer or his authorized representative is present to sign receipts, supervise unloading and deliver the transit bus complete with bill of sale and warranty to the proper State employee at the address shown on the purchase order. Delivery by any method is not acceptable unless the transit bus is accompanied by the bill of sale.

At time of delivery the gasoline tank must be at least one-fourth (1/4) full as indicated on the gauge. All vehicles shall be delivered with adequate radiator protection, to at least 20 degrees below zero, by a good grade of Ethylene Glycol Anti-Freeze.

All delivery shall be made between the hours of 9:00 a.m. to 12:00 Noon or 1:00 p.m. to 4:00 p.m., Monday through Friday, holidays excepted.

WARRANTY: The Standard Factory Warranty shall apply to all transit buses. A properly executed warranty MUST be delivered with each transit bus. All service called for in the Standard Warranty shall apply without exception. An owner's care book shall also be included with each vehicle.

Supplemental Specifications
for
Small Transit Bus
(16-21-Passenger)

OPTION ITEMS:

AIR CONDITIONING: Air conditioning equipment shall be installed capable of providing adequate cooling and dehumidifying capacity for passenger comfort. The delivery system shall provide a reasonably constant temperature throughout the vehicle. The system shall be capable of maintaining a temperature of 75 degrees Fahrenheit (F) and 50 percent humidity inside the vehicle at 90 degrees F outside temperatures and extremely high humidity conditions.

The bidder shall provide complete details on the compressor, condenser and evaporator units and shall state exactly the power required to operate the condenser fans whether electrical or mechanical.

The air conditioning equipment shall be installed in a manner that will not affect the seating capacity of the vehicle. All controls will be located to allow convenient access from the operator's seat. All wiring, tubing and fitting shall be encased to provide maximum protection against accidental damage.

SCHOOL BUS OPTION: This option contains two bid items.

Option 1: Chassis and Body Modification: This item shall include all modifications required to bring the base vehicle into compliance with Federal and Kansas school bus requirements with the exception of the items specified in Option 2 below. Please list the modifications to be provided.

Option 2: Paint, Lettering and Lighting: This item includes any additional cost for paint and lettering required of school buses, additional lighting and stop arm installation to bring the vehicle into full compliance.

Note: Option 1 may be specified individually, however, Option 2 will only be specified as an addition to Option 1.

FORM OF BID

SMALL TRANSIT BUS
16-21-Passenger

ESTIMATED QUANTITY		
1	Small Transit Bus 16-21-Passenger	$_____/ea.

OPTIONS:

_1_ Air Conditioning _____

School Bus Option

_1_ Option 1: Chassis and Body Modification _____

_1_ Option 2: Paint, Lettering and Lighting _____

The above must meet the attached Specifications Titled Small Transit Bus (16-21-Passenger)

Specify Make and Model of the Vehicle Offered:

_____

Specify approximate delivery date _____.

APPENDIX G

ATTORNEY GENERAL OPINION OF ARTICLE 9 OF KANSAS STATE CONSTITUTION

STATE OF KANSAS

Office of the Attorney General

1st Floor, State Capitol Bldg. (913) 296-2215 Topeka, Kansas 66612

Curt T. Schneider
Attorney General

October 18, 1977

ATTORNEY GENERAL OPINION NO. 77-341

Mr. Donald S. Simons
Chief Attorney
Kansas Department of Transportation
State Office Building
Topeka, Kansas 66612

Re: Airports--State Grants--Constitutionality

Synopsis: Under Article 11, § 9 of the Kansas Constitution, neither the Secretary of Transportation nor any other state agency or official may provide financial assistance to public agencies in the state for the construction of airports and airport facilities, whether the funds for the assistance derive from state sources or non-state sources, including the federal airport and airway trust fund.

* * *

Dear Mr. Simons:

I have your letter of October 14, 1977, enclosing a copy of an opinion from your office of the same date, addressed to Mr. Ray Arvin, Director of Aviation, and considering the question whether the State of Kansas may accept and disburse funds which are proposed to be allocated to it under proposed amendments to the Airport and Airways Development Act of 1970, 49 U.S.C. § 1701 et seq.

As background for this question, your opinion indicates that the Congress has established a trust fund for the proceeds of federal aviation fuel and registration taxes. Under the Act the Congress reserves to itself the right to allocate those funds. However, the trust fund has now grown to approximately three billion dollars of unallocated moneys. In order to expedite the allocation of

the fund, it has been proposed that the fund be allocated proportionately to each of the states, which would then distribute airport development moneys directly to municipalities, to be used for the construction, development and improvement of local airport facilities. Each state would establish standards and criteria determining eligibility for the funds, and its only responsibility to the federal government would be to provide an accounting of the expenditure of the funds.

In 1970, the Kansas legislature enacted legislation designed to facilitate implementation of federal airport acts in Kansas. Those acts are defined by K.S.A. 3-604(b) to include

> "the aviation facilities expansion act of 1969 or the airport and airways development act of 1969 or such other title as the referred to acts shall be finally enacted under by the United States congress during its 1970 session, and such other existing federal acts as are referred to therein."

Under K.S.A. 3-605, the Kansas Secretary of Transportation is hereby empowered to

> "(1) act as the agent of sponsors located in the state;
> (2) accept in behalf of the sponsors and disburse to them all payments made pursuant to agreements under the federal airport act;
> (3) acquire by purchase, gift, devise, lease, or otherwise, any property, real or personal, or any interest therein, including easements, necessary to establish or develop airports;
> (4) engage in airport systems planning on a statewide basis; and
> (5) undertake airport development, or provide financial assistance to public agencies within the state for carrying it out."

In Opinion No. 76-296, I concluded that Article 11, § 9 of the Kansas Constitution prohibits use of state funds for the construction and development of municipal and county airports. It is

unnecessary to repeat or recapitulate that opinion here, other than to note that clearly, an airport is an "internal improvement" to which the state may not be a party under the cited provision of our state constitution:

> "The state shall never be a party in carrying on any work of internal improvement except that: (1) It may adopt, construct, reconstruct and maintain a state system of highways, but no general property tax shall ever be laid nor general obligation bonds issued by the state for such highways; (2) it may be a party to flood control works and works for the conservation or development of water resources." [Emphasis supplied.]

In opinion nos. 76-296 and 75-315, I discussed this prohibition at some length. You suggest, however, that it should not be deemed to apply to internal improvements undertaken with funds which are derived from non-state, i.e., federal, sources. I cannot agree. The language of Article 11, § 9 is unusually forthright and unqualified: "The state shall never be a party in carrying on any work of internal improvement . . . ." [Emphasis supplied.] Nothing in this language suggests that the state may be a party to internal improvements which are constructed with federal funds, but not with state funds. In Opinion No. 75-315, I stated that there is "no more meaningful manner in which the state may be deemed to be a party to an undertaking than that it appropriates and obligates funds therefor." As you describe the proposed changes, monies in the airport and airway trust fund would be distributed to the states on a proportionate basis, presumably according to a formula to be approved by the Congress. The monies so allocated to Kansas would be deposited in the state treasury, presumably, see K.S.A. 75-3734, to await appropriation for the construction, development and improvement of local airport facilities, either through appropriation for specific projects, or through appropriation to a state official, as, e.g., the Secretary of Transportation, who would then approve particular projects for funding, on the basis of duly adopted criteria for eligibility, and distribute the funds accordingly. On the basis of the information you provide, it is apparent to me that funds allocated to the State of Kansas from the airport and airway trust fund must be deposited in the state treasury; those moneys may not be spent, then, without duly enacted appropriations. In appropriating the funds for the construction of airports and airport facilities, the state thereupon becomes a party to those improvements.

It is suggested that the use of federal funds for these projects affords an additional basis for distinguishing Article 11, § 1. In State ex rel. Boynton v. Atherton, 139 Kan. 197, 30 P.2d 291 (1934), and other decisions, cited in the referenced opinions above, the Kansas Supreme Court pointed out the historical origin of the section, noting that it was prompted by the nearly bankrupting experiences of other states which had undertaken ill-conceived and extravagant programs of public improvements, incurring great indebtednesses in the course thereof. Thus, it is suggested that because no state funds are involved in the proposed airport projects, and thus no state indebtedness can result, Article 11, § 9 should not be deemed applicable. However, Article 11, § 9 does not prohibit the state from being a party to only those works of internal improvement for which an indebtedness is contracted. Article 11, § 6 deals specifically with the insurring of public debts by the state. Article 11, § 9, flatly prohibits the state from being a party to internal improvements, without regard to the source of funding, whether it be from state levies, from federal revenue-sharing monies, or any other special revenues, either state or federal, and without regard to the incurring of any indebtedness therefor.

Lastly, it is suggested that the state may act as an agent of the federal government, and the Federal Aviation Administration or other appropriate federal agency, in the administration of these funds, and that Article 11, § 9 does not prohibit the state's construction of public improvements in the capacity as an agent for its principal, the federal government. The theory is as unconvincing as it is novel. In the first instance, it is entirely unclear that under the proposed amendments to the Airport and Airway Development Act of 1970, that the state in fact is merely an agent of the United States or its Secretary of Transportation. Secondly, Article 11, § 9 prohibits the state's being a party to an internal improvement in any capacity. That section imposes a clear limitation upon the legislative power of the state. The legislature may not authorize that which the constitution forbids. The federal government may be a party to internal improvements. The state may not. The state may not avoid this constitutional limitation upon its legislative power merely under the guise of agency, for what it may not do for itself, it may not do for another. The legislature is powerless to authorize the state or its agencies to act in an agency capacity in violation of the Kansas Constitution.

In sum it is my opinion that under Article 11, § 9 of the Kansas Constitution, neither the Secretary of Transportation nor any other state agency or official may provide financial assistance to public agenices in the state for the construction of airports

and airport facilities, whether the funds for that assistance derive from state sources or non-state sources, including the federal airport and airway trust fund.

Yours truly,

CURT T. SCHNEIDER
Attorney General

CTS:JRM:kj

RECEIVED
OCT 21 1977
LEGAL DEPARTMENT
TOPEKA, KANSAS

A MODEL APPROACH FOR PLANNING A SUBREGIONAL TRANSIT SYSTEM

by

Henry O. Boaten

B. S., University of Science & Technology, 1975
Kumasi, Ghana

AN ABSTRACT OF A MASTER'S THESIS
submitted in partial fulfillment of the
requirements for the degree

MASTER OF REGIONAL & COMMUNITY PLANNING

Department of Regional & Community Planning

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1978

ABSTRACT

The greatest thing in the world is not so much where we stand as what direction we are moving. To reach the port of Heaven we must sail sometimes with the wind and sometimes against it, but we must sail and not drift, or lie at anchor. ---------- Oliver Wendell Holmes.

This is all that "planning" attempts to achieve and the planning process described in this thesis is a step toward helping to sail rather than drift. This author sought out to define the transportation problems of one segment of the population and propose a planning process suitable for developing solutions to these problems in non-metropolitan areas.

Chapter I deals with a general introduction and the major processes described subsequently in this thesis.

Chapter II deals with an innovative approach to define the suitable area to do transit planning. An area larger than "local" jurisdictions was recommended but it was cautioned that administrative and political feasibility should take preference over technical dictation.

As discussed in Chapter III in developing goals and objectives, citizen input regarding transportation concerns is highly necessary. Therefore, a survey and its analysis is also presented to formulate goals and objectives for the study area.

Chapters IV and V describe the "tooling up" processes, and essentially deals with elements and methods needed for assessing present conditions of a study area.

Analytical techniques are contained in the following chapters:

Chapter VI - Estimating Demand for Transit Market

Chapter VII - Evaluation of Existing Transit Services

The last part of the planning process model deals with Formulating Transit Options and Evaluating Alternatives as discussed in Chapter VIII. Chapter IX deals with Planning for Transit Implementation and Management.

The model has been developed particularly for non-metropolitan areas using Riley and Geary Counties as a study area. If areas such as these primarily rural counties decide there is a need for a full areawide public transportation study, this report should serve as a helpful manual.